Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

07-KBC-0013

DEC 08 2006

Mr. Nicholas Ceto, Program Manager
Office of Environmental Cleanup
Hanford Project Office
U.S. Environmental Protection Agency
309 Bradley Blvd., Suite 115
Richland, Washington 99352

Dear Mr. Ceto:

TRANSMITTAL OF K BASINS SLUDGE TREATMENT REMEDIAL DESIGN REPORT/REMEDIAL ACTION WORK PLAN – GENERAL AND PHASE 3, SLUDGE ASSAY AND SOLIDIFICATION

The purpose of this letter is to transmit the following documents for the U.S. Environmental Protection Agency's (EPA) review and approval:

- Remedial Design Report and Remedial Action Work Plan for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage, DOE/RL-2006-06, Revision 0, Draft.
- Remedial Design Report for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage, Phase 3: Sludge Assay and Solidification, DOE/RL-2006-06.3, Revision 0, Draft.

These were prepared as post Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Record of Decision documents, per Section 7.3 of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement). Advance drafts of these documents have been shared with EPA's Hanford Site Office and their comments incorporated. The remedial design for K Basins sludge treatment and interim storage will be submitted for review and approval in several phases as the remedial design progresses. It has been recognized that the development and submittal of remedial design and remedial action documents in phases is appropriate to expedite the remedial action, "A Guidance on Expediting Remedial Design and Remedial Action, EPA/540/G-90/006, EPA, Washington, D.C."

Therefore, the remedial design for sludge treatment is being divided into the following phases which have also been discussed with EPA:

Phase 1 – Transfer of Sludge from the K West Basin to the Cold Vacuum Drying Facility
Phase 2 – Corrosion of Sludge
Phase 3 – Sludge Assay and Solidification
Phase 4 – Treated Sludge Interim Storage at T Plant and Disposal

Phase 5 – Transfer and Treatment Equipment Decontamination and Decommissioning

It should be noted that since the issuance of the K Basins CERCLA Record of Decision amendment, there have been changes to one of the Waste Management Standards. The waste acceptance criteria for the Waste Isolation Pilot Plant (DOE/WIPP-02-3122) has been revised to Revision 6, effective November 15, 2006. Impacts from changes in this standard will be addressed in separate correspondence.

If you have any questions, please contact me, or your staff may contact Paul Pak, of my staff, on (509) 376-4798.

Sincerely,

David A. Brockman

David A. Brockman, Federal Project Director
for K Basin Closure

KBC:EBD

Attachments

cc w/attachs:
Administrative Record
Environmental Portal

cc w/o attachs:
R. E. Piippo, FHI

DOE/RL-2006-06
Revision 0
Draft
(Pending RL and EPA Approval)

Remedial Design Report and Remedial Action Work Plan for the K Basins Interim Remedial Action:

Sludge Treatment and Interim Storage

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

DOE/RL-2006-06
Revision 0
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Remedial Design Report and Remedial Action Work Plan for the K Basins Interim Remedial Action:

Sludge Treatment and Interim Storage

Date Published
November 2006

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

J. D. Aardal 11/13/2006
Release Approval Date

DOE/RL-2006-06

Revision 0

Draft
(Pending RL and EPA Approval)

EXECUTIVE SUMMARY

This document identifies the remedial design and remedial action work plan for treatment of sludge removed from the 105-K East (KE) Basin (Operable Unit 100-KR-2, Site 100-K-42) and 105-K West (KW) Basin (Operable Unit 100-KR-2, Site 100-K-43). It summarizes the overall remedial action approach for the treatment of K Basins sludge and identifies general aspects of the design and remedial action work plan for implementing the design. As the remedial design progresses, additional details of the sludge treatment design will be prepared and submitted for approval in phases. These phases include the following:

- Phase 1 – Transfer of Sludge from the KW Basin to the Cold Vacuum Drying Facility (CVDF)
- Phase 2 – Corrosion of Sludge
- Phase 3 – Sludge Assay and Solidification
- Phase 4 – Treated Sludge Interim Storage at T Plant and Disposal
- Phase 5 –Transfer and Treatment Equipment Deactivation

The original *Remedial Design Report / Remedial Action Work Plan (RDR/RAWP) for the K Basins Interim Remedial Action* (DOE-RL, 2001a) did not address treatment of sludge. The *Record of Decision (ROD) for the K Basins Interim Remedial Action* (EPA, 1999a) directed that the removed sludge be stored in the 200 Area while providing that sludge that met the Environmental Restoration Disposal Facility (ERDF) waste acceptance criteria could be treated under the ROD for disposal at ERDF. An amended remedy was presented in the *ROD Amendment for the K Basins Interim Remedial Action* (EPA, 2005). The amended remedy requires the sludge to be treated; packaged for disposal; interim stored pending shipment; and shipped to a national repository for disposal. The sludge has been determined to be a transuranic (TRU) waste and will be treated and packaged for disposal, and shipped in the future off-Hanford to the DOE's Waste Isolation Pilot Plant (WIPP). Treated and packaged sludge that meets the ERDF waste acceptance criteria will be disposed at ERDF.

The K Basins sludge treatment and interim storage includes;

- The transfer of sludge from containers, settler tanks and knock-out-pots in the KW Basin to the CVDF for stabilization and packaging,
- Stabilization of uranium metal fines and metal hydrides in the sludge using a high temperature water oxidation process to ensure the uranium is not pyrophoric or reactive and will not generate hydrogen gasses above acceptable levels,
- Assaying of sludge to ensure the appropriate proportions of treated sludge and cement are metered into waste drums to ensure treated waste meets current radiological packaging, interim storage and disposal facility requirements,
- Mixing and solidification of sludge in 55-gallon containers,

- Actions during processing to document acceptable knowledge in preparation for interim storage and eventual disposal at the WIPP,
- Accumulation and interim storage of stabilized and packaged waste inside and outside the CVDF prior to shipment to T Plant,
- Interim storage of stabilized and packaged waste at T Plant until development and certification of a remote-handled (RH) TRU waste program at Hanford followed by disposal at the WIPP, and
- Deactivation and flushing of the sludge transfer and treatment equipment to acceptable levels.

Each phase of the remedial design identified above will include a description of the Applicable or Relevant and Appropriate Requirements (ARARs) and other criteria, advisories, or guidance to-be-considered (TBC) that apply to the scope of work for the design phase.

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ACRONYMS

ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirements
AK	Acceptable Knowledge
BARCT	Best Available Radionuclide Control Technology
CBFO	Carlsbad Field Office
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH	Contact-Handled
Ci	Curies
CVDF	Cold Vacuum Drying Facility
DOE	Department of Energy
DQO	Data Quality Objective
EPA	Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FGE	Fissile Gram Equivalent
IPAN	Imaging Passive Active Neutron
KBC	K Basins Closure
KE	K East
KOP	Knock-Out-Pot
KW	K West
LDR	Land Disposal Restriction
MOSS	Mobile Solidification System
NDA	Non-destructive assay
NLOP	North Loadout Pit
PCB	Polychlorinated Biphenyl
OU	Operable Unit
RAOs	Remedial Action Objectives
RBDA	Risk-based Disposal Approval
RDR/RAWP	Remedial Design Report / Remedial Action Work Plan
RH	Remote-Handled
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SSAPS	Sludge Stabilization and Packaging System
SNF	Spent Nuclear Fuel
STP	Sludge Treatment Project
TBC	To-be-considered
TRAMPAC	Transuranic Waste Authorized Methods for Payload Control
TRU	Transuranic
WAC	Waste Acceptance Criteria
WCPIP	Waste Characterization Program Implementation Plan (Remote-Handled TRU)
WIPP	Waste Isolation Pilot Plant

DEFINITIONS

Acceptable Knowledge (AK). Information about the waste based on the material and processes that generated the waste and the procedures and policies that were used to package and manage the waste. AK includes, but is not limited to, information about the physical form of the waste, the base materials composing the waste, the radiological characteristics of the waste, and the process that generated the waste. AK includes any documentation that describes or verifies site history, mission, and operations, in addition to waste stream-specific information used to define the generating process, matrix, and contaminants (radiological and chemical).

Nondestructive Assay (NDA). Nondestructive Assay is a term used to define methods for determining the radionuclide content of the waste without destroying or changing the waste form chemically or physically. NDA, in conjunction with AK, can be used to establish Transuranic (TRU) activity, total activity, isotopic activity, and activity per canister. NDA is used in conjunction with AK information or a documented study that provides the needed relationship between NDA and the isotopic characteristics of the waste.

PCB remediation waste. PCB remediation waste means waste containing PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations: Materials disposed of prior to April 18, 1978, that are currently at concentrations ≥ 50 ppm PCBs, regardless of the concentration of the original spill; materials which are currently at any volume or concentration where the original source was ≥ 500 ppm PCBs beginning on April 18, 1978, or ≥ 50 ppm PCBs beginning on July 2, 1979; and materials which are currently at any concentration if the PCBs are spilled or released from a source not authorized for use under this part. PCB remediation waste means soil, rags, and other debris generated as a result of any PCB spill cleanup, including, but not limited to:

(1) Environmental media containing PCBs, such as soil and gravel; dredged materials, such as sediments, settled sediment fines, and aqueous decantate from sediment.

(2) Sewage sludge containing < 50 ppm PCBs and not in use according to Sec. 761.20(a)(4); PCB sewage sludge; commercial or industrial sludge contaminated as the result of a spill of PCBs including sludges located in or removed from any pollution control device; aqueous decantate from an industrial sludge.

(3) Buildings and other man-made structures (such as concrete floors, wood floors, or walls contaminated from a leaking PCB or PCB-Contaminated Transformer), porous surfaces, and non-porous surfaces.

Process Knowledge (PK). Process knowledge refers to applying knowledge of the waste in light of the materials or processes used to generate the waste. PK is detailed information on the wastes obtained from existing published or documented waste analysis data or studies conducted on wastes generated by processes similar to that which generated the waste. PK may include information on the physical, chemical, and radiological properties of the materials associated with the waste generation process(es), the fate of those materials during and subsequent to the process, and associated administrative controls. PK commonly includes detailed information on the waste obtained from existing waste analysis data, review of waste generating process(es), or detailed information relative to the properties of the waste that are known due to site-specific and/or process-specific factors.

Remote-Handled (RH) Waste. Waste with a surface dose rate of 200 mrem/hr or greater.

Sludge. Sludge is any material in the K Basins water that will pass through a screen with 0.25 in. (.64 cm) openings. Sludge on the floor and in the pits is a mix of fuel corrosion products (including metallic uranium, and fission and activation products), small fuel fragments, iron and aluminum oxide, concrete grit, sand, dirt, operational debris, and biological debris.

Transuranic (TRU) Waste. Waste containing greater than 100 nCi/g of alpha-emitting TRU radionuclides with half-lives greater than 20 years.

INTRODUCTION

PURPOSE

The purpose of this Remedial Design Report / Remedial Action Work Plan (RDR/RAWP) is to describe the remedial design, design basis and the remedial actions to treat sludge removed from the 105-K East (KE) Basin (Operable Unit 100-KR-2, Site 100-K-42) and 105-K West (KW) Basin (Operable Unit 100-KR-2, Site 100-K-43) in preparation for eventual disposal at the Department of Energy's (DOE) Waste Isolation Pilot Plant (WIPP) as described in the *Record of Decision (ROD) Amendment for the K Basins Interim Remedial Action* (EPA, 2005). The sludge is a remote-handled (RH) transuranic (TRU) PCB remediation waste and is eligible for disposal at the WIPP.

The original *RDR/RAWP for the K Basins Interim Remedial Action* (DOE-RL, 2001a) did not address the treatment of sludge. The *ROD for the K Basins Interim Remedial Action* (EPA, 1999a) directed that the removed sludge be stored in the 200 Area of the Hanford Site while providing that sludge that met the Environmental Restoration Disposal Facility (ERDF) waste acceptance criteria could be treated under the ROD for disposal at ERDF. An amended remedy was presented in the *ROD Amendment for the K Basins Interim Remedial Action* (EPA, 2005). The amended remedy requires the sludge to be treated; packaged for disposal; interim stored pending shipment, and shipped to a national repository for disposal. The sludge will be treated and packaged for disposal, and shipped in the future off-Hanford to the DOE's WIPP. Treated and packaged sludge that meets the ERDF waste acceptance criteria will be disposed at ERDF.

SCOPE

This RDR/RAWP applies to the K Basin treatment and interim storage of the balance of sludge. Sludge retrieved from the KE North Loadout Pit (NLOP) to Large Diameter Containers is treated under a separate remedial design (DOE-RL, 2005a) and was not included in the scope of this project. The scope addressed in this aspect of the K Basins interim remedial actions includes the following:

- The transfer of sludge from containers, settler tanks and knock-out-pots (KOPs) in the KW Basin to the Cold Vacuum Drying Facility (CVDF) for stabilization and packaging,
- Stabilization of uranium metal fines and metal hydrides in the sludge using a high temperature water oxidation process to ensure uranium is not pyrophoric or reactive and will not generate hydrogen gasses above acceptable levels,
- Assaying of sludge to ensure the appropriate proportions of sludge and cement are metered into waste drums to ensure treated waste meets current radiological packaging, interim storage and disposal facility requirements,
- Mixing and solidification of sludge in 55-gallon containers,
- Actions during processing to document the waste treatment in preparation for interim storage and eventual disposal at the WIPP,
- Accumulation and interim storage of stabilized and packaged waste inside and outside the CVDF prior to shipment to T Plant,

- Interim storage of stabilized and packaged waste at T Plant until development and certification of an RH TRU waste program at Hanford followed by disposal at the WIPP, and
- Deactivation and flushing of the sludge transfer and treatment equipment to acceptable levels.

This document does not address development of a Hanford RH TRU program for the waste certification or the eventual disposal of the treated sludge at the WIPP. While the sludge characterization performed during this remedial action is intended to prepare a certifiable sludge waste stream for disposal at the WIPP and collect relevant acceptable knowledge (AK) information, additional characterization may be required and the qualification of existing information will be required upon development and certification of the Hanford RH TRU program.

BACKGROUND

The 105-K Basins are located in the northern part of the DOE Hanford 100 Area, Hanford Site, Benton County, Washington, next to the Columbia River (Figure 1-1). The basins received spent nuclear fuel (SNF) from the 105-KE and KW reactors and subsequently stored SNF awaiting disposition. The rectangular concrete basins are approximately 38 meters (125 feet) long and 20 meters (67 feet) wide and adjoin the reactor buildings. Each basin is filled with approximately 5 meters (16 feet) of water to provide radiation shielding for facility workers and to minimize the release of radioactive particles to the air. Sludge accumulated primarily on the floor of the KE Basin during the operational period of the basin. Detailed description of the K Basins background is provided in the *ROD for the K Basins Interim Remedial Action.*

Description of Sludge

The K Basins sludge consists of a radioactive mix of fuel corrosion products (including fission and activation product nuclides), small fuel fragments, iron and aluminum oxides, concrete grit, sand, dirt, operational and biological debris (FH, 2006a). Portions of the sludge that originated in the spent fuel storage canisters was accumulated in the KOP and settler tanks in the system that maintained the KW Basin water clarity during the process of cleaning and repacking the spent fuel. The remaining sludge that was distributed on the KE and KW Basin floor is consolidated in containers for interim storage prior to treatment. Approximately 3.5 cubic meters of as-settled sludge was removed from the KE NLOP and sent to T Plant for solidification. The remaining sludge in the KE NLOP will be placed in the KE Basin sludge containers with the rest of the sludge removed from the KE Basin floor.

As a result of the sludge generation and consolidation processes, there are three sludge streams that require stabilization and packaging:

- KOP sludge
- Settler tank sludge
- Containerized sludge

KOP sludge is expected to predominately consist of materials ranging in size from somewhat less than 0.64 cm (0.25 inch) and generally greater than 500/600 microns, with some smaller diameter particles intermixed with trace amounts of polychlorinated biphenyls (PCBs). The nominal estimate for the quantity of KOP sludge is 0.26 m^3.

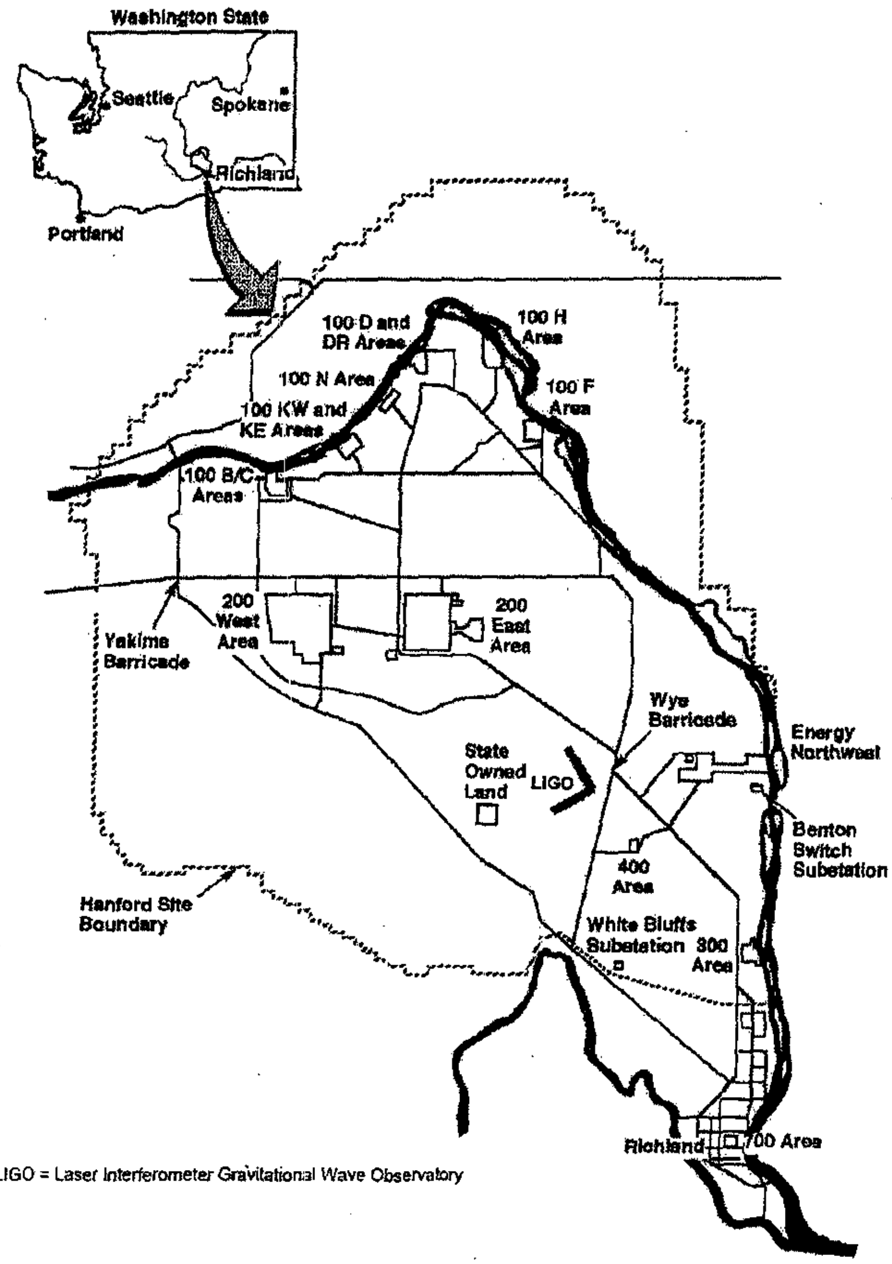

Figure 1-1. K Basins Location

Settler tank sludge is expected to consist of particles ranging in size from somewhat less than 500/600 microns to submicrons in diameter and includes metallic fuel corrosion products (e.g., metallic uranium, uranium oxides, and fission and activation products). It may also include very small fuel fragments, iron and aluminum oxide, sand, Grafoil (i.e., flexible graphite seal material) fragments, concrete grit, trace amounts of PCBs, dirt, operational debris and biological debris. The nominal estimate for the quantity of settler tank sludge is 5.4 m^3.

The containerized sludge particle size distribution generally ranges from 0.64 cm (0.25 inch) to submicron diameters and includes metallic fuel corrosion products (e.g., metallic uranium, uranium oxides, fission and activation products), small fuel element fragments, iron and aluminum oxide, sand, Grafoil pieces, concrete grit, ion exchange resin beads, cationic polymer flocculent, trace amounts of PCBs, dirt, operational debris and biological debris. The nominal estimate for the quantity of containerized sludge is 41 m^3, exclusive of the remaining volume of NLOP sludge.

K Basin sludge has been characterized and determined to not be a hazardous or dangerous waste (DOE-RL, 2001b). The sludge is a PCB remediation waste.

RDR/RAWP Organization

The *RDR/RAWP for the K Basins Interim Remedial Action* (DOE-RL, 2001a) describes the overall interim remedial actions to be taken at the K Basins as described in the 1999 ROD. Remedial actions to: improve basin water quality; remove and dispose of water during operations; remove SNF, debris and sludge; grout the discharge chutes; consolidate sludge in containers; and transfer sludge to the KW Basin have been performed under the 2001 RDR/RAWP and several supplements.

Since issuance of the RDR/RAWP in 2001 the *K Basins Interim Remedial Action ROD* has been amended and rather than revise the 2001 RDR/RAWP to reflect these and other administrative changes, this RDR/RAWP was developed to summarize the overall remedial design for sludge treatment, interim storage and disposal. The plan describes the remedial design, implementation of the design, and elements of the RDR/RAWP that are common to all remaining aspects of the sludge remedial actions in response to the ROD amendment (EPA, 2005). For sludge treatment, the work plan included in this document (Section 4.0) will be used in lieu of the 2001 *RDR/RAWP for the K Basins Interim Remedial Action.*

The remedial design for the K Basins sludge treatment and interim storage is organized into five phases which will be developed as the remedial design progresses. It is recognized that variations can and will occur in individual projects wherein the development and submittal of remedial design and remedial action documents in phases is appropriate to expedite the remedial action (EPA, 1990). The phases include the following:

- Phase 1 – Transfer of Sludge from the KW Basin to the CVDF
- Phase 2 – Corrosion of Sludge
- Phase 3 – Sludge Assay and Solidification
- Phase 4 – Treated Sludge Interim Storage at T Plant and Disposal
- Phase 5 –Transfer and Treatment Equipment Deactivation

Interfaces with existing systems (e.g., air emissions control systems) to be used in the design will be described in the specific phase identified. Similarly interfaces between equipment and processes in one phase with equipment and processes in another phase will also be described.

Implementation of the processes in this plan will be used to meet one of the project end point criteria established for the K Basins interim remedial action for sludge stabilization and packaging as described in the *End Point Criteria for the K Basins Interim Remedial Action* (FH, 2005a) (see Section 5.1). The relationship of this document to the K Basins documents referenced is depicted in Figure 1-2.

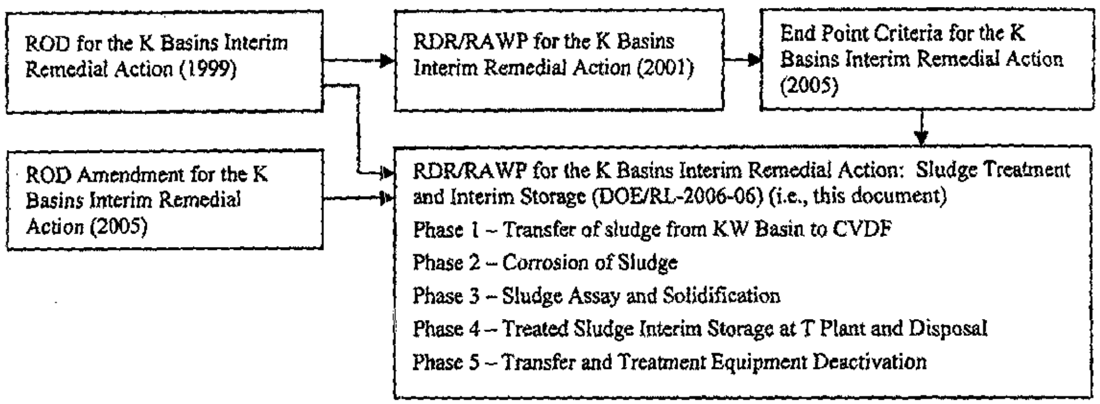

Figure 1-2. Relationship of Existing Documents to the Sludge Treatment Project RDR/RAWP Phases

This RDR/RAWP is organized into six sections:

1.0 Introduction: The introduction presents the purpose and scope of the sludge treatment project, the project background and general sludge characteristics, and describes the relationship of this RDR/RAWP to the 2001 RDR/RAWP.

2.0 Remedial Design: Summarizes the project-specific remedial design. Future submittals for the project phases identified in Figure 1-2 will specify details of the remedial design for the specific phase of the sludge treatment remedial action.

3.0 Design Basis: The design basis summarizes the remedial action objectives, how the criteria specified in the ROD will be satisfied and a summary of requirements applicable to the project.

- Remedial Action Objectives—Identifies the remedial action objectives from the ROD (EPA, 1999a) that are relevant to this aspect of the K Basins interim remedial action and a description of the design aspects that address them.
- Applicable or Relevant and Appropriate Requirements and TBCs.—Summarizes the Applicable or Relevant and Appropriate Requirements (ARARs) and to-be-considered materials (TBCs) that must be addressed and implemented during this remedial action. Remedial design submittals for the individual project phases will identify the specific requirements, criteria and compliance methodology for the phase.
- Other Design Considerations—Identifies DOE orders, other basis documents and quality assurance standards considered in the remedial design.

4.0 Remedial Action Work Plan: Describes the plan to implement the remedial design.

- Project Controls— Describes the project organization and identifies the project schedule and cost.
- Remedial Action Work Elements— Remedial action work elements identify the primary work elements and operations undertaken to perform the remedial action. The elements

described in this remedial action work plan describe aspects such as the procurement strategy and construction for the Sludge Stabilization and Packaging System.

- Planning Documentation—Identifies relevant documents and processes to ensure the remedial action goals are met. Additional planning documents may be identified during the remedial design phases.
- Remedial Action Change Management—Identifies the change management system for the Sludge Treatment Project (STP) remedial design or remedial action documents should changes be needed.

5.0 Project Closure: Describes the project end point criteria and describes project closure verification and documentation.

6.0 References: Identifies documents referenced in this RDR/RAWP.

REMEDIAL DESIGN

Overview

The remedial design for the K Basins Sludge Treatment Project includes a system to remove the sludge from KW Basin containers and vessels and transfer it to the CVDF for stabilization and packaging. The CVDF contains 5 processing bays. Sludge stabilization and packaging includes evaporation (concentration), corrosion of uranium using a high temperature water oxidation process followed by assaying and grouting. These activities will be carried out using equipment located in Bays 1 and 2 of the CVDF (Figure 2-1). The packaging containers for stabilized sludge are 55-gallon drums. Treated and packaged sludge will be accumulated in Bay 3 at the CVDF for curing and preparation for shipment. The stabilized and packaged sludge will then be shipped to T Plant for interim storage pending ultimate disposition at the WIPP. Sludge will be packaged in 55-gallon drums to optimize the payload and minimize the number of containers for eventual shipment to the WIPP, while maintaining a safe retrieval, transport and interim storage configuration (i.e., critically safe, thermally stable, non-explosive atmosphere).

The main components of the Sludge Stabilization and Packaging System (SSAPS) are the 1) dewatering system and sludge corrosion system, 2) the Imaging Passive Active Neutron (IPAN) system to determine container loading limits to meet Fissile Gram Equivalency (FGE) requirements for each waste container, provide information to derive total curies and gross gamma measurements for ^{137}Cs, 3) a Mobile Solidification System (MOSS), 4) cleaning and verification technician station, 5) windows, 6) manipulators, 7) drum handling system, 8) lag storage system, 9) cement supply tank and feed system, 10) Nitrogen and feed system, 11) concrete shielding around process equipment, 12) control facilities and 13) miscellaneous hardware that is required to fully install an operating SSAPS. A loading and contingent/surge storage area will be located outside of the CVDF. Packaged drums will be transported to T Plant for interim storage until shipment to the WIPP.

The design phases of the STP process include the following:

Phase 1 - Transfer of sludge from the KW Basin to the treatment location: Sludge will be transferred from containers and vessels located in the KW Basin to the corrosion and dewatering system located in the CVDF. A hose-in-hose system is included in the preliminary design. Multiple batches will be transferred based on considerations that include Corrosion Vessel size, type of sludge and criticality.

Phase 2 - Corrosion of sludge: After sludge is received in the Corrosion Vessel in the CVDF excess water will be removed by evaporation to achieve the appropriate solids concentration for corrosion. Excess water will be removed from the off-gas using a condensate unit and returned to the KW Basin or treated as necessary for transfer to the Effluent Treatment Facility. Corrosion of the sludge is performed to convert uranium metal to uranium oxide to reduce the evolution of hydrogen from uranium in the sludge and meet transportation and disposal criteria. Uranium in the sludge will be corroded using elevated temperature and pressure to accelerate the process. The waste will be agitated during the corrosion process. The treatment system for off-gas generated from the corrosion system and the assay and solidification systems (Phase 3) is described in Phase 2 of the remedial design.

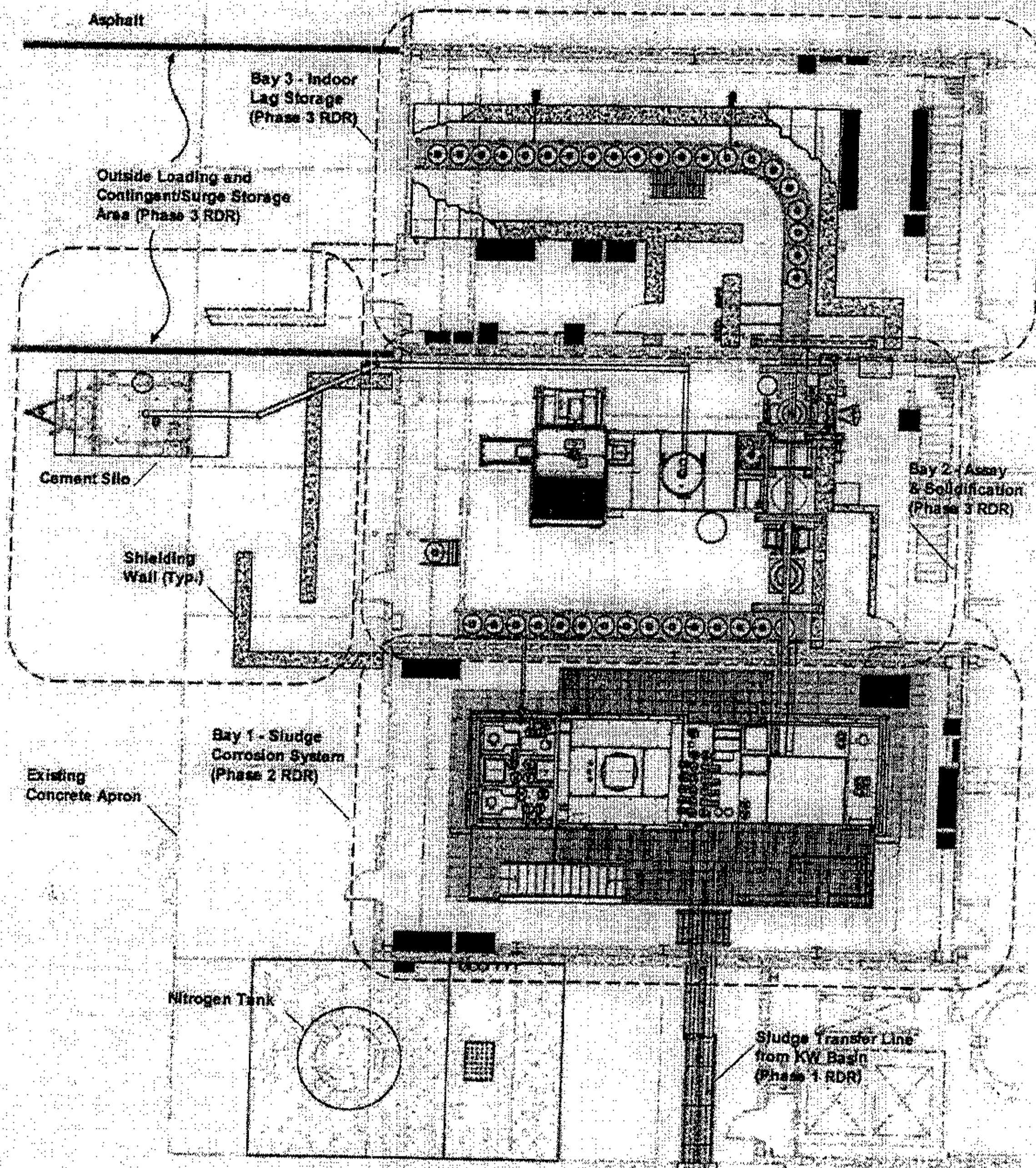

Figure 2-1. Sludge Stabilization and Packaging System – Floor Plan

Phase 3 - Sludge assay and solidification: Upon completion of sludge corrosion the treated sludge is transferred from the Corrosion Vessel to an Assay Vessel in batches. The volume transferred is then assayed using an IPAN system to determine the radiological characteristics of the Assay Vessel contents. Thereafter an appropriate volume of sludge is discharged to a 55-gallon drum in the MOSS where the sludge is mixed with cement and solidified. After the drum is filled and closed, drum handling equipment moves the drum to a decontamination area where the external surface is tested for contamination and decontaminated as needed. Containers of treated sludge will be staged at the CVDF prior to transport for storage or disposal. Treated and packaged sludge will be accumulated in Bay 3 where curing of the waste into a solid form will occur. Drums of RH TRU waste will then be moved outside the CVDF and packaged for shipment to T Plant. Drums of contact-handled (CH) TRU waste, if any, will be packaged for shipment to the 200 Area for storage and processing under the CH TRU program. A loading and temporary storage area will be identified outside the CVDF for use during staging for shipment and for contingent/surge storage.

Phase 4 - Treated sludge interim storage at T Plant and disposal: Containers of RH TRU will be transferred to T Plant for storage and future processing under the Hanford RH TRU Program for eventual disposal at the WIPP. Containers of CH TRU, if any, will be transferred to the 200 Area for storage and processing under the Hanford CH TRU Program. Drums of treated and solidified sludge that are LLW, if any, will be transferred to an established CERCLA staging area in the 100 K area for evaluation for disposal at the ERDF or other EPA approved 200 Area waste management facility.

Phase 5 - Transfer and treatment equipment deactivation: Equipment and interconnected piping used to transfer sludge from the KW Basin to the CVDF and treat sludge will be flushed with water to minimize the residual sludge volume. Upon completion of equipment flushing, the heel remaining in the treatment vessels will be removed. Affected areas of the CVDF used for the treatment of sludge will be decontaminated to levels based on as low as reasonably achievable (ALARA) considerations. Removal and disposal of the CVDF sludge treatment equipment and sludge transfer equipment located outside the KW Basin will be performed as evaluated in the *Engineering Evaluation/Cost Analysis for the 105-KE and 105-KW Reactor Facilities and Ancillary Facilities* (DOE-RL, 2006) and in accord with the corresponding Action Memorandum. Sludge transfer equipment within the KW Basin will be deactivated under the *RDR/RAWP for the K Basins Interim Remedial Action* (DOE-RL, 2001a) with final remedial action occurring under the *Interim Action ROD for the 100 Area Remaining Sites* (EPA, 1999b).

Each phase of the remedial design identified above will include a description of the ARARs, TBCs and other design considerations that apply to the scope of work for the design phase, compliance methodologies, interfaces with existing facility systems and services and interfaces with other elements of the sludge treatment system described in related phases of the design.

DESIGN BASIS

Remedial Action Objectives

The Remedial Action Objectives (RAOs) identified in the 1999 ROD apply to the removal of SNF from the K Basins; sludge removal, treatment, interim storage and disposal; water and debris removal and disposal; and deactivation of the K Basins. The remedial actions described herein are designed to achieve the relevant RAOs for the K Basin sludge treatment and interim storage and are therefore described only in that context. RAOs as presented in the ROD are provided below in italics followed by a description of how they are achieved.

1. *Reduce the potential for future releases of hazardous substances from the K Basins to the environment.*

   - *Remove hazardous substances from the K Basins near the Columbia River in a safe and timely manner.*
   - *Provide for safe treatment, storage, and final disposal of the sludge, water, and debris*[1] *removed from the K Basins.*

   The RAO is met through removal of sludge consolidated in the KW Basin to the CVDF and subsequent treatment and interim storage of the sludge. The potential for a release of sludge from the K Basins will have been substantially minimized through remedial actions taken to remove sludge from the containers in the KE Basin to containers in the KW Basin prior to implementation of this scope of work. Further actions undertaken under the scope of this RDR/RAWP remove the sludge from containerized storage at the KW Basin to the CVDF followed by stabilization (i.e., corrosion and solidification) to meet the requirements for interim storage in the 200 Area and appropriate criteria outlined in the TBC materials of the *Remote-Handled TRU Waste Characterization Program Implementation Plan* (WCPIP) (DOE/WIPP, 2003) and other design considerations. Treated RH TRU sludge will be stored at T Plant until such time that a Hanford RH TRU Program is developed and certified by the DOE Carlsbad Field Office (CBFO) and EPA for shipment to the WIPP. As identified in Section I, the treatment of sludge has been accelerated by including sludge treatment in the scope of the K Basin interim remedial action. This provides a more timely and cost effective remedy.

2. *Reduce occupational radiation exposure to workers at the basins.*

   The second RAO is met by developing and implementing ALARA plans and specified time, distance and engineering controls; through design of shielding for the treatment system and interim storage; through implementation of design elements developed based on safety analyses performed; and through implementation of standard practices to minimize airborne radioactivity.

[1] The sludge treatment project RAOs address sludge treatment, interim storage and disposal; the management of water removed from the sludge during treatment; and the management of debris generated as a result of treating the sludge. Basin water and debris are addressed under the *RDR/RAWP for the K Basins Interim Remedial Action* (DOE-RL, 2001a).

3. *Address the sludge management concerns identified in Section 5.2.1 (i.e., ROD for the K Basins Interim Remedial Action).*

   (From Section 5.2.1) *The surface dose for an unshielded container of sludge is many times higher than the 200-mrem/hr limit for contact-handled waste. The contact dose associated with floor and pit sludge could be as high as 128,000 mrem/hr and the contact dose rate associated with canister and wash sludge could be as high as 1.75 million mrem/hr. Because of this, it is anticipated that containers of sludge will need to be managed as a remote-handled waste unless special overpacking is provided.*

   Sludge that exceeds the 200-mrem/hr limit will be managed as RH waste. The sludge treatment facility design and operating practices will accommodate the anticipated dose rates. The sludge treatment system is designed to produce a waste form that will meet the WIPP dose requirements for RH TRU containers as well as other design considerations for the interim storage and transportation of RH TRU as described in Sections 3.3 and 3.4.

   (From Section 5.2.1) *The high concentrations of fissile materials (uranium and plutonium) require careful evaluation of criticality control for all activities involving the sludge.*

   Criticality hazards have been evaluated during the design phase and are controlled through engineering controls. The KOP Accumulation Container and the CVDF Corrosion Vessel have controlled dimensions for criticality safety which ensure that even when full they will remain subcritical.

   (From Section 5.2.1) *Metal fines and metal hydrides in the sludge (e.g., uranium, uranium hydride, and zirconium) are potentially pyrophoric, reactive, and capable of generating flammable gas.*

   Metal fines and metal hydrides in the sludge will be treated through a high temperature water oxidation (i.e., corrosion) process during this remedial action. Sludge once treated through the process will not be pyrophoric or reactive and will not generate hydrogen gasses above acceptable levels identified for transportation (DOE/WIPP, 2002). A sampling and analysis plan (SAP) will be developed following the EPA Data Quality Objective (DQO) process described *EPA Guidance for Data Quality Objective Process*, EPA QA/G-4 to document how DQOs in the *Remote-Handled TRU Waste Characterization Program Implementation Plan* (DOE/WIPP, 2003) are met, including the potential for sludge to be pyrophoric, reactive, and capable of generating flammable gas.

4. *Develop the most cost effective site-wide approach, consistent with the CERCLA nine criteria, for treatment, storage, and disposal of sludge.*

   The determination to treat sludge at this time rather than deferring treatment is described in the *ROD Amendment for the K Basins Interim Remedial Action* (EPA, 2005). Treatment was accelerated since additional information concerning the sludge characteristics had become available; disposal facility characterization requirements were better defined; and adding treatment prior to interim storage would save costs. The approach was evaluated against the nine CERCLA criteria as documented in the *Addendum to the Focused Feasibility Study* (DOE-RL, 2005b). Sludge will be treated to meet TBCs identified in the WCPIP and other criteria identified in this plan to prepare the waste for interim storage and eventual disposal at the WIPP. The treatment and waste management operations will be conducted to ensure important characterization criteria are met and that appropriate AK information is collected during stabilization and packaging. Under this approach, the treated waste and AK information developed under this remedial action will be evaluated under a RH TRU Program certified by the CBFO and EPA prior to shipment to the WIPP.

5. *Treat, store, and/or dispose of sludge soon after removal.*

   This RAO is met through implementation of RAOs 1 and 4.

Certifiability

Treated and packaged K Basins sludge is considered certifiable when the sludge has been treated and packaged in a system that was designed and operated to yield an RH TRU waste form[2] meeting the *Hanford Site Solid Waste Acceptance Criteria* (FH, 2006b). The requirements for preparing an RH TRU waste form to meet WIPP certification are incorporated into the *Hanford Site Solid Waste Acceptance Criteria*. The sludge treatment system and implementation processes described in this RDR/RAWP are designed to meet the Hanford waste acceptance criteria and collect AK information for future qualification and use under a certified RH TRU program.

Applicable or Relevant and Appropriate Requirements and TBC Material

Under CERCLA Section 121 (42 USC 9601 et seq.) and the National Oil and Hazardous Substances Pollution Contingency Plan (55 FR 46), remedies are selected that are protective of human health and the environment, that comply with ARARs, that are cost-effective, and that utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ, as a principal element, treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous wastes, and has a bias against off-site disposal of untreated wastes.

The purpose of this section is to discuss how ARARs and TBC materials identified in the ROD that apply to the K Basin STP will be met during the remedial actions. Activities performed in the implementation of this remedial action at Hanford's 100 K Area occur on-site, as defined in the National Contingency Plan. Activities performed in the implementation of this remedial action at Hanford's 200 Area are considered off-site.

Remedial actions that apply to on-site activities as described in this document need only meet the substantive requirements in the ROD. While disposal of RH TRU waste at an off-site national repository (i.e., WIPP) will occur in the future, the actual disposal will occur under a certified RH TRU program developed to meet the requirements in the WCPIP and other transportation and acceptance requirements. Since waste treated under this remedial action must ultimately meet the waste acceptance criteria of the WCPIP and AK developed under this treatment process will be used in the eventual certification of the waste for shipment to the WIPP, certain AK requirements from the WCPIP that are administrative in nature are included in the interim remedial action.

The ARARs and TBCs identified in the ROD and ROD amendment that apply to the K Basin sludge treatment project are identified below. In addition, other considerations used in the design are identified. Details of ARARs, TBCs and other design considerations that apply

[2] CH TRU, if produced will be certified under the existing Hanford CH TRU Program.

broadly to the entire STP and their implementation strategy are described below. Details of ARARs, TBCs and other design considerations and the implementation strategy for them are provided in individual phases of the remedial design report as noted below.

Implementation of the ROD-selected remedies for the K Basin interim remedial actions described in this plan will comply with the federal and state ARARs. No waiver of any ARAR is being sought.

Environmental Protection Standards

Designation, Reportable Quantities, and Notification (40 CFR 302)

The requirements of 40 CFR 302 are applicable to new releases of CERCLA hazardous substances that could occur during the K Basins interim remedial action. The substantive requirements include:

- Determining if new releases of hazardous substances exceed reportable qualities.
- Reporting release to the appropriate emergency response agencies.

The K Basins Closure (KBC) Project contractor has developed and implements processes that address spills and reportable releases that include notification and response.

Waste Management Standards

PCB Waste Management and Disposal (40 CFR 761)

The storage and disposal of K Basins sludge under this remedial action differs from the self implementing and performance based disposal options described in 40 CFR 761 but adopts the tenants of a risk-based disposal option (40 CFR 761.61(c)) as described below.

Regulations regarding polychlorinated biphenyl (PCB) wastes apply to the storage and disposal of K Basins sludge, both a multi-phasic PCB waste as described in 40 CFR 761.1(b)(4) and a PCB remediation waste (40 CFR 761.3). Sludge is a multi-phasic waste because it is comprised of both a liquid phase (water) and a solids phase. The selected remedy in the ROD amendment consists of treating sludge as a remote-handled TRU waste for disposal off site at a national repository. That treatment consists of hot water oxidation for converting the uranium metal into uranium oxide followed by solidification into a grouted matrix.

When disposing of a multi-phasic PCB remediation waste, three disposal options are available under 40 CFR 761.61; self implementing, performance based, or risk based. Under the self implementing disposal and performance based disposal options, both phases shall be managed in a manner that assumes each phase contains PCBs at the higher PCB concentration level. Although PCBs have not been found in the liquid phase of the sludge (with a detection limit of 0.5 ppb) the liquid phase must still be disposed of as if it contains PCBs. The prescribed method in 40 CFR 761.60 to dispose of liquid PCBs is through incineration. Incineration cannot be performed on the K Basins sludge due to the high radioactivity and removal of the liquid cannot be performed as it is part of the waste matrix that will undergo hot water oxidation and then be grouted. Therefore, a risk-based disposal option as afforded in (40 CFR 761.61(c)) will be implemented.

The *Focused Feasibility Study for the K Basins Interim Remedial Action* (DOE-RL, 1999) presented an evaluation to demonstrate that the hazards associated with managing the PCB component of the sludge present little risk to human health or the environment. Since that time a RBDA that addressed the processing of liquid to non-liquid PCB remediation waste for a subset of the K-Basin sludge (i.e. the 105-K East Basin NLOP sludge) was approved by EPA (EPA, 2005b). Based on these prior analyses and the low hazards and risks associated with the PCB component in the sludge, the alternative disposal and storage methods described herein and in the individual remedial design phases comprise the basis for alternative disposal and storage methods from those prescribed under 40 CFR 761.61 and 40 CFR 761.65 for this CERCLA interim remedial action. The EPA approval of the RDR/RAWP constitutes approval of the risk based disposal in accord with 40 CFR 761.61(c).

Similarly, storage of PCB remediation waste under 40 CFR 761.65 requires specific secondary containment configurations based on the physical form of the waste, visual inspections, and specific spill/release response provisions. While similar in the intent to protect human health and the environment, these measures differ in specifics from those necessary to protect human health and the environment from the hazards posed by a remote-handled radioactive waste. Since this sludge waste must be managed to address the more significant hazards posed by the radioactive properties of the waste, including oxidation and stabilization to meet criteria for disposal at the WIPP, secondary containment systems, system monitoring and provisions for spill/release response, the waste will be managed based only on the radiological hazard. The design for managing this remote-handled TRU waste are described in Section 2.0, *Remedial Design* and the appropriate design phases and are equally protective of human health and the environment.

Land Disposal Restrictions (40 CFR 268), (WAC 173-303-140)

The Land Disposal Restrictions (LDR) (40 CFR 268) pursuant to the *Resource Conservation and Recovery Act* (42 USC 6901, *et seq.*) are applicable for establishing treatment standards and storage requirements prior to disposal of any dangerous or mixed wastes generated as part of the K Basins interim remedial action. The Washington Administrative Code (WAC) LDRs incorporate the Federal RCRA LDR Requirements in 40 CFR 268 and introduce additional requirements for State-only dangerous wastes.

K Basin sludge has been characterized and determined to not be a hazardous waste (DOE-RL, 2001b). However, debris and wastes generated during the operation and deactivation of the STP may generate hazardous or mixed wastes. Dangerous or mixed waste or debris generated during implementation of the STP or during deactivation of the transfer and treatment equipment will be treated in the near-term if practicable at the 100-K Area or at ERDF to meet the LDR standards. If near-term treatment to meet LDRs is not practicable prior to disposal, the waste or debris will be stored at the Central Waste Complex, which is permitted for dangerous and mixed waste storage. Dangerous wastes that may be recycled using established Hanford site-wide processes will be recycled where practicable.

Dangerous Waste Regulations (WAC 173-303)

The substantive requirements of WAC 173-303 pursuant to the state *Hazardous Waste Management Act* (70.105 RCW) are applicable for the identification, treatment, storage, and disposal of dangerous and mixed wastes generated during the K Basins interim remedial action. The substantive requirements include those contained in the following:

- Designate waste (WAC 173-303-070) – Solid, dangerous and mixed wastes may be generated during the K Basins remedial action.
- Storage (WAC 173-303-630) – Dangerous waste that may be generated during this phase of the remedial action and removed (versus grouted) may include hazardous debris and liquids removed from mechanical equipment.

K Basin sludge has been characterized and has been determined to not be a dangerous waste (DOE-RL, 2001b).

Characteristic dangerous waste may be identified during sludge treatment or during the deactivation of the transfer and treatment equipment. Debris and other wastes will be designated using WAC 173-303-070 through -110 as defined in SAPs such as the *Sampling and Analysis Plan for the K Basins Debris* (FH, 2005b). Details of requirements and compliance methodologies will be described in individual phases of the remedial design, as appropriate.

Licensing Requirements for Land Disposal of Radioactive Waste (10 CFR 61).

The substantive requirements in 10 CFR 61 pursuant to the *Atomic Energy Act* are relevant and appropriate to radioactive waste generated by the K Basins interim remedial action and taken for disposal at the Hanford Site. Relevant and appropriate requirements are the general prohibition on near-surface disposal of greater-than-Class-C radioactive waste and the general performance objectives stated in 10 CFR 61.40. Waste classification (10 CFR 61.55) and waste characterization (10 CFR 61.56) are relevant and appropriate to the disposal of radioactive wastes at a location other than WIPP. Details of requirements and compliance methodologies will be described in individual phases of the remedial design, as appropriate.

Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste (40 CFR 191)

The *Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste* (40 CFR 191) pursuant to the Atomic Energy Act are applicable to TRU waste generated by the K Basins interim remedial action. On-site disposal of TRU waste is prohibited by this regulation. On Hanford Site disposal of TRU is not proposed.

To-Be-Considered pursuant to relevant facility acceptance criteria

Environmental Restoration Disposal Facility Waste Acceptance Criteria (BHI-00139)

The ERDF Waste Acceptance Criteria (BHI, 2002 and BHI, 2003) establish the acceptance criteria for waste destined for management at ERDF to ensure proper disposal.

A SAP has been developed for K Basins debris (FH, 2005b). The SAP will be reviewed and revised, as necessary to address debris generated through deactivation of the transfer and treatment equipment. Additional wastes that may be generated during the operation of the sludge treatment process may be identified. This may include solidified rinsates from the deactivation of the transfer and treatment equipment. SAPs will be developed for these waste streams. SAPs for waste streams that may be disposed of at the ERDF will address ERDF waste acceptance criteria.

Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-02-3122)

This document establishes CH TRU waste acceptance criteria for WIPP (DOE/WIPP, 2005). CH TRU waste destined for management at WIPP must meet acceptance criteria to ensure proper disposal. CH TRU waste may be generated during the operation or deactivation of the treatment system that will require management. CH TRU stabilized sludge generated through the STP will be transferred to the 200 Area for management under the certified CH TRU program.

Remote-Handled Transuranic Waste Characterization Program Implementation Plan for the Waste Isolation Pilot Plant (DOE/WIPP-02-3214)

The WCPIP (DOE/WIPP, 2003) establishes one of the bases for the development of generator site RH TRU waste characterization programs and identifies waste acceptance criteria for RH TRU waste to be managed at the WIPP. Remote-handled TRU waste destined for management at WIPP must meet the waste acceptance criteria to ensure proper disposal. Characterization of the RH TRU waste must be performed under a certified RH TRU program using testing, visual evaluations (VE) and/or the qualification and use of existing information, as appropriate.

A certified RH TRU program will not likely be in place at the time of sludge treatment. Until that certified RH TRU program is in place elements of the WCPIP will be implemented as described in this RDR/RAWP, the project specific SAPs and QA plans. Therefore compliance with requirements in the WCPIP will be met in two parts: 1) through actions undertaken during the remedial action to treat sludge before certification of an RH TRU program based on the requirements identified in the WCPIP and 2) through development of an RH TRU program and future characterization under a certified RH TRU program. Elements of the Hanford RH TRU Program development are summarized in Figure 3-1.

The design and operation of the treatment system is based on requirements in the WCPIP and other design considerations to prepare a waste form that may be certified in the future for disposal at the WIPP. Information developed during sludge treatment will be considered existing information in the future and will require qualification under the certified Hanford RH TRU program in the future.

The treatment system design includes a corrosion process to address the generation of gas from the sludge, an assay system (i.e., Imaging Passive Active Neutron [IPAN] system) wherein corroded sludge will be assayed prior to solidification to ensure appropriate identification and quantification of radionuclides, visual evaluation processes and a solidification process to meet physical requirements. Details of the corrosion system will be provided in Phase 2, *Corrosion of Sludge*. Details of the IPAN system and solidification system will be provided in Phase 3, *Assay and Solidification*.

The design and operation of the sludge treatment system will include implementation of QA Program requirements for activities performed prior to establishment of a certified RH TRU Program as described in Section 3.4.4, *Quality Assurance* and the collection of records identified in Section 5.3, *Project Closure Documentation*.

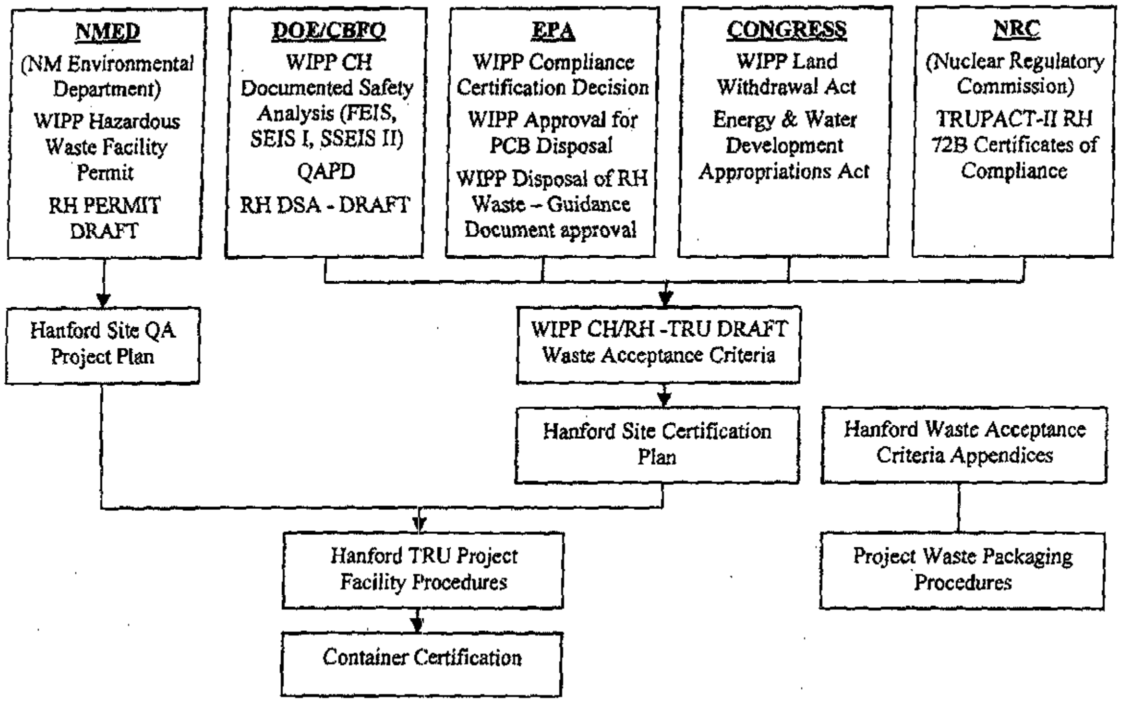

Figure 3-1. Elements of the Hanford RH TRU Program Development

Standards for Controlling Emissions to the Environment

National Emission Standards for Hazardous Air Pollutants (40 CFR 61); *Radiation Protection - Air Emissions,* (WAC 246-247); *Ambient air quality standards and emission limits for radionuclides,* (WAC 173-480-070-2)

Substantive requirements of these standards are applicable because this remedial action includes onsite treatment of radioactive sludge, operation of emissions systems and generation of radioactive contaminated waste and debris during operation and system deactivation. Substantive requirements include:

- 40 CFR 61.92 - Emissions of radionuclides to the ambient air shall not exceed amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.
- 40 CFR 61.93 - Emissions from major point sources of airborne radioactive material shall be measured. Measurement techniques may include, but are not limited to, sampling, calculation, smears, or other reasonable methods for identifying emissions.
- WAC 246-247-040(3) and WAC 173-480-060- Emissions from new construction or significant modifications to existing systems shall be controlled to assure emission standards are not exceeded and/or to ensure that emissions are controlled using Best Available Radionuclide Control Technology (BARCT).
- WAC 246-247-075(8) - Emissions from minor point sources and non-point and fugitive sources of airborne radioactive material shall be measured.

- WAC 173-480-050-(1) - At a minimum all emission units shall make every reasonable effort to maintain radioactive materials in effluents to unrestricted areas ALARA. Control equipment of facilities operating under ALARA shall be defined as reasonably available control technology.
- WAC 173-480-070-(2) - Determine compliance with the public dose standard by calculating exposure at the point of maximum annual air concentration in an unrestricted area where any member of the public may be.

The SSAPS that will be installed in the CVDF will contribute to the radiological air emissions from the facility. The corrosion system, off-gas quench vessel, off-gas treatment skid, Assay Vessel and MOSS drum dosing head and drip pan ventilation systems, will connect to the existing CVDF centralized ventilation system. The centralized ventilation system includes emission control equipment and emission monitoring equipment for these exhaust streams prior to exiting the system via the CVDF main stack. Details of the emission control and emission monitoring systems, which make up BARCT for sludge treatment, and the associated potential to emit and abated emissions are described in Phase 2, *Corrosion of Sludge* of the RDR.

Emissions Standards for Asbestos, Standard for Demolition and Renovation (40 CFR 61.145, 40 CFR 61.150)

Regulated asbestos containing materials are not anticipated during this aspect of the remedial action.

General Regulations for Air Pollution, (WAC 173-400)

Substantive requirements of this standard are applicable to this remedial action because there may be visible, particulate, fugitive, and hazardous air emissions resulting from material handling, corrosion or stabilization activities[3]. As a result, standards established for the control and prevention of air pollution are applicable. Substantive requirements include:

- WAC 173-400-040 - Methods of control shall be employed to minimize the release of air contaminants associated with fugitive emissions resulting from materials handling, construction, demolition, or other operations. Emissions are to be minimized through application of best available control technology.

Details of the requirements and compliance methodologies will be described in the individual remedial design phases, where appropriate.

Hazardous air emissions for new sources of air emissions, (WAC 173-400-113 and WAC 173-460)

Substantive requirements of these standards are applicable to this remedial action because there is the potential for toxic air pollutants to become airborne as a result of onsite stabilization and packaging of sludge and decontamination activities. As a result, standards established for the control of toxic air contaminants are applicable. Substantive requirements include:

[3] Emissions with odors subject to regulation under WAC 173-400-040 are not anticipated during this aspect of the remedial action.

- WAC 173-400-113 The proposed new source or modification will employ best available control technology for all pollutants not previously emitted or whose emissions would increase as a result of the new source or modification
- WAC 173-460-050 and 070 - Emissions of toxic air contaminants shall be quantified and ambient impacts evaluated.
- WAC 173-460-060 - Best available control technology for toxics shall be used as appropriate to protect human health and the environment.

Emissions of toxic air contaminants will be evaluated during the development of Phase 2, *Corrosion of Sludge* of the remedial design.

Standards for Protecting Human Health

The Nuclear Regulatory Standards for Protection Against Radiation (10 CFR 20); Radiation Protection Standards (WAC 246-221); *Environmental Radiation Protection Standards for Nuclear Power Operations* (40 CFR 190); and *Department of Energy Occupational Radiation Protection* (10 CFR 835)

Regulations under 10 CFR 20, WAC 246-221 and 40 CFR 190 are relevant and appropriate to establishing public dose limits for activities implemented under the K Basins interim remedial action. Regulation under 10 CFR 835 is applicable to activities undertaken as part of the K Basins interim remedial action. Substantive requirements include:

- 10 CFR 20, WAC 246-221 - The dose to an individual member of the public cannot exceed 0.1 rem/year (100 mrem/year) total effective dose equivalent and 2 mrem/hr from external exposure in unrestricted areas.
- 40 CFR 190 - Relevant and appropriate requirements are those that limit dose to 25 mrem/year to whole body, 75 mrem/year to thyroid, and 25 mrem/year to any other organ.
- 10 CFR 835 – Applicable requirements establish a worker dose limit of 5 rem/year total effective dose equivalent.

The remedial design of the SSAPS includes design and operational aspects that consider dose to the individual member of the public and the worker. The corrosion system, IPAN and MOSS designs include shielding to minimize exposure to the workers during operations. A shield door located between Bay 2 and Bay 3 limits dose from the product drums awaiting collection. Shielding shall be placed around the Bay 3 staging location to keep radiological exposure ALARA to the other occupants of the facility. The drum loading and contingency/surge storage area outside the CVDF will be provided with shielding (i.e., concrete culverts, blocks or other shielding).

Physical barriers and administrative processes are used to control access to the CVDF. Radiological control programs are implemented by the KBC contractor that control and monitor doses to affected workers to maintain exposure ALARA.

Emissions from the SSAPS will be vented through a treatment skid prior to connecting to the existing CVDF centralized ventilation system. The centralized ventilation system includes control equipment prior to exiting the system via the main stack. Estimates for anticipated radiological emissions from the SSAPS to the centralized ventilation system, a description of modifications to the existing control equipment to treat off-gas generated from the corrosion system and the assay and solidification systems and emission monitoring for the centralized ventilation system are described in Phase 2 of the remedial design.

During operation of the SSAPS smearable and mobile contamination on treatment equipment will be removed, isolated or immobilized (e.g., decontamination, fixing contamination by applying fixatives, or similar) as needed to operate and maintain the treatment system. Drums of treated waste will be decontaminated to meet Hanford WAC for RH waste (FH, 2006b) on exiting the MOSS prior to transfer to the lag storage area in Bay 3 of the CVDF as described in Phase 3 of the remedial design.

Smearable and mobile contamination on debris generated during deactivation of the STP transfer and treatment equipment will be isolated or immobilized (e.g., wrapping waste in plastic, fixing contamination by applying fixatives, using CONEX boxes, using covered ERDF roll-off containers).

Standards for Transportation of Hazardous Materials

Hazardous Materials Regulation, 49 CFR 171 and Hazardous Materials Tables, 40 CFR 172

The *Hazardous Materials Regulation* and *Hazardous Materials Tables* pursuant to the *Hazardous Materials Transportation Act* (49 USC 1801-1813) are applicable to any offsite transportation of potentially hazardous materials, including samples and wastes generated by the K Basins interim remedial action. Substantive requirements include:

- Packaging shipments of hazardous materials in U.S. Department of Transportation approved shipping containers
- Marking containers to indicate associated hazards.

Offsite shipments of hazardous materials are not anticipated except for the future shipment of treated RH TRU sludge and CH TRU sludge, if any, to the WIPP. Other design considerations (Section 3.4) made during development of this remedial design include requirements from the *Remote-Handled Transuranic Waste Authorized Methods for Payload Control* (RH TRAMPAC). Requirements in the RH TRAMPAC are established to ensure compliance of the payload with the transportation parameters of the 72-B Cask that is used to ship RH TRU to the WIPP. Details of the compliance methodologies to meet the RH TRAMPAC will be described in the individual phases of the remedial design, where appropriate. CH TRU stabilized sludge generated through the STP will be transferred to the 200 Area for management under the certified CH TRU program which includes compliance with transportation requirements.

Standards for Protecting the Cultural, Historic and Natural Resources

National Historic Preservation Act (16 USC 470, *et. seq.)*

The *National Historic Preservation Act* and implementing regulations are applicable to those activities associated with the K Basins interim remedial action that might affect properties in the 100-K Area that may be eligible for listing on the National Register of Historic Places. Substantive requirements include:

- Appropriate protection of properties of historic significance is required.

Cultural and historic reviews have been preformed to identify properties that may be eligible for listing on the National Register of Historic Places. The 105-KW building, including the fuel storage basin is a "contributing property with no individual documentation required" (DOE-RL, 1997). The 142 K Building is a recent building and has no historical significance. This phase of the K Basins remedial action has no impact on those properties.

National Archeological and Historical Preservation Act (16 USC 469a)

The *National Archeological and Historical Preservation Act* and implementing regulations are applicable to those activities associated with the K Basins interim remedial action that might affect archeological or historic data in the 100-K Area. Substantive requirements include:

- Appropriate responses are required in the event that artifacts are discovered.

Cultural and historic reviews have been preformed to identify properties of historic and cultural value. This phase of the K Basins remedial action has no impact on those properties nor will any ground disturbing activities take place in areas that have not been disturbed in the past construction activities associated with the construction of the K Basins. Therefore artifacts are not anticipated.

Endangered Species Act (16 USC 1531, *et. seq.*)

The *Endangered Species Act* implementing regulations are applicable to those activities associated with the K Basins interim remedial action that might jeopardize any threatened or endangered species or habitats in the 100-K Area. Substantive requirements include:

- Appropriate actions must be taken to protect species and habitats.

A bald eagle monitoring plan has been prepared and field work completed that demonstrates that construction and operations activities at 100-K have no impact on the roosting behavior of bald eagles nearby at the river shore. There are no activities taking place in previously undisturbed areas. No impacts on protected species or habitats are expected.

Hanford Reach Study Act (Public Law 100-605, as amended)

The *Hanford Reach Study Act* is applicable because the K Basins interim remedial action takes place near the Columbia River. Substantive requirements include:

- Appropriate actions must be taken to minimize and mitigate for direct and adverse impacts on the river.

Systems and structures for the transfer, stabilization and packaging of sludge are designed pursuant to other applicable regulations that are directed at protecting the environment. The process associated with the transfer, stabilization and packaging of sludge does not discharge effluents to the Columbia River.

OTHER Design ConsiderATIONS

U.S. Department of Energy

While not considered ARARs, the following DOE orders apply to the design and implementation of the K Basin sludge treatment and interim storage:

- DOE Order 413.1, Management Control Program

- DOE Order 435.1, Radioactive Waste Management
- DOE Order 450.1, Environmental Protection Program
- DOE Order 5400.5, Radiation Protection of the Public and Environment
- DOE Order 5480.4, Environmental Protection, Safety, and Health Protection Standards

DOE Orders are implemented during planning, design, construction and operation of this remedial action.

Hanford Site Solid Waste Acceptance Criteria

The *Hanford Site Solid Waste Acceptance Criteria* (FH, 2006b) identifies the requirements for the acceptance of waste at Hanford Site Solid waste management facilities including that for RH TRU waste. Requirements include general and facility specific requirements that must be met. Aspects of the requirements for RH TRU from the RH TRAMPAC and conformance with the WCPIP are incorporated into the WAC and are therefore not reiterated. CH TRU, greater-than-Class-C and LLW may be generated during the STP construction and operation. Requirements in the Hanford Site Solid WAC will be evaluated for applicability to each appropriate waste stream and implemented during the waste management process.

RH TRU Waste Authorized Methods for Payload Control

Waste characterization requirements for sludge will include those identified in the RH TRU 72-B Cask Safety Analysis Report (DOE/WIPP, 2002), Rev. 3, Appendix 1.3.7, *Remote-Handled Transuranic Waste Authorized Methods for Payload Control* (RH TRAMPAC). The 72-B Cask is the only currently identified acceptable shipping container for transporting RH TRU to the WIPP. While not considered an ARAR or TBC, the remedial design will consider substantive applicable requirements from this document.

Requirements in the RH TRAMPAC are established to ensure compliance of the payload with the transportation parameters of the 72-B Cask. The RH TRAMPAC defines payload requirements under the following categories:

1. Container and physical properties
2. Nuclear properties
3. Chemical properties
4. Gas generation
5. Payload assembly
6. Quality assurance.

Details of the requirements and compliance methodologies will be described in the individual phases of the remedial design where appropriate.

Quality Assurance

The sludge treatment design and operation will be conducted under a QA program that is equivalent in effect to ASME NQA-1-1989 edition, *Quality Assurance Requirements for Nuclear Facility Applications,* ASME NQA-2a-1990 addenda, part 2.7, of ASME NQA-2-1989 edition, and ASME NQA-3-1989 edition[4] (excluding Section 2.1 (b) and (c) and Section 17.1). The WIPP WCPIP and 40 CFR 194.22 allow qualification of information collected prior to the establishment of an RH TRU QA Program designed to meet the requirements of the CBFO Quality Assurance Program Document provided the information is collected under a QA program that is in effect equivalent to the listed standards[5].

The RH TRAMPAC requires that certification of authorized contents for shipment in the RH TRU 72-B cask shall be performed under a written QA program that provides confidence, for both the shipper and receiver, that the RH TRAMPAC requirements have been met. Although certification of the payload will not be performed at this time, RH TRAMPAC payload characterization activities described in this RDR will be performed under a Quality Assurance/Quality Control program that meets the requirements of the WCPIP, as described above.

Sampling and analysis plans referenced herein or developed for this project follow the *EPA Guidance for Data Quality Objective Process*, EPA QA/G-4 (EPA, 2000) in their development and include quality assurance processes in accordance with *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5 (EPA, 2001).

4 The quality assurance requirements for the collection of scientific and technical information for site characterization of High Level Nuclear Waste Repositories do not apply to the STP.

5 DOE/WIPP-02-3214, *Remote-Handled Transuranic Waste Characterization Program Implementation Plan for the Waste Isolation Pilot Plan*, Section 4.3, Qualification of AK Information.

REMEDIAL ACTION WORK PLAN

The remedial action work plan identifies the approach to implementing the remedial action. This RAWP identifies the work plan elements of the design that are common to all life-cycle aspects of the K Basins Sludge Treatment Project.

Project Controls

Project controls include field oversight/construction management, protocol and coordination of field oversight, project cost estimate and the project schedule.

Field Oversight / Construction Management

The EPA is identified as the Lead Regulatory Agency for OU 100-KR-2 (Sites 100-K-42 and 100-K-43). DOE-RL is the Lead Agency. The DOE-RL remediation project manager will be responsible for notifying the EPA of project activities. The DOE-RL remediation project manager will also serve as the primary interface for all routine contact between the Agencies and the KBC Project contractor.

The KBC Project contractor will provide field oversight, construction management services and operations for this project. The KBC Project contractor will also provide field support services for engineering, testing, health and safety, radiological control, environmental compliance, nuclear safety analysis, waste management, quality assurance, and landlord services. The KBC Project organization is described in the *K Basins Closure Project Execution Plan* (FH, 2005c). Interim storage of stabilized and packaged RH TRU at T Plant followed by eventual disposal at the WIPP will be provided by the Waste Stabilization and Disposition Project.

Protocol and Coordination of Field Oversight

The DOE-RL will notify the EPA OU Manager of pending remedial action activities, such as major activities including testing and startup, closure verification and closeout.

Project Schedule and Cost

Project schedule and cost baselines are developed and maintained under a process that is responsive to the requirements of DOE Order 413.1. This is described in further detail in the *K Basins Cleanup Project Execution Plan* (FH, 2005c). The plan identifies the current strategies and project implementation control systems for the KBC Project. Baseline schedules reflect the authorized baseline work scope activities. Major milestones, interim milestones and target dates for the K Basin STP are identified in the *Hanford Federal Facility Agreement and Consent Order* (hereafter referred to as the Tri-Party Agreement).

The baseline schedule is monitored by the KBC Project and significant actions are evaluated using a risk management process developed consistent with DOE Order 413.1. In this process significant actions and their potential technical, schedule and cost risks are identified, analyzed and ranked; and mitigating factors are identified, managed and monitored. The risk evaluation process results and updates are used as the basis to periodically (e.g., at quarterly Tri-Party Agreement milestone review meetings) inform the DOE-RL and EPA of risk status and any schedule and cost impacts. Schedule changes that affect Tri-Party Agreement milestones are made according to the *Tri-Party Agreement Action Plan*, Section 12, *Changes to the Agreement*.

Detailed working schedules are also maintained by the project that reflects the sequence of activities. These schedules are to guide the week-to-week work planning execution.

Remedial Action Work Elements

Remedial action work elements identify the primary steps and controls to implement the remedial design. Remedial action work elements described below identify the procurement strategy and controls to be used during the modification to existing facilities and construction and installation of new equipment for the STP. Details of the SSAPS are identified in the remedial design phases.

Access Control

The 100-K Area has existing fencing that establishes an access control boundary to the entire area. Most work conducted under this remedial action occurs within the controlled KW Basin building and the CVDF. The sludge transfer system between the KW Basin and the CVDF is located outside buildings. The transfer system is located within the controlled area of the 100-K Area. Current building access controls used during operations will be used in this remedial action. Temporary access control measures will be used to restrict access into work areas as necessary. Contamination control boundaries will be established and marked by the radiological control personnel. Ingress and egress control of contaminated areas will be defined in radiological work permits.

Procurement

The design of the STP includes the procurement and off-site construction and testing of systems and subsystems that are delivered and then assembled at the CVDF. The procurement of systems and subsystems required to implement this remedial action will be procured using a phased approach consistent with the development of the remedial design. As remedial design progresses, systems and subsystems will be procured, fabricated, tested as appropriate and delivered. In some instances, aspects of long lead-time items may be procured and off-site fabrication initiated before the remedial design for the entire system is complete. Similarly, for items where the outcome of the final design has little bearing on the component (such as in off-the shelf items), pre-procurement activities may be performed before the remedial design is complete.

Construction

Pre-mobilization

Prior to mobilization for each remedial action task, documentation to support the work control for that task will be prepared. Job safety analyses, radiological work permits, ALARA reviews, operational procedures and other work control forms will be prepared for major aspects of the remedial action, as appropriate.

Mobilization

Mobilization activities are required for construction of the sludge transfer system and the SSAPS. Site preparation for these activities may require minor site grading and/or addition of base material, installing temporary barriers and signs, and establishing and erecting temporary equipment.

Control of Fugitive Dust

Operations outside the basin such as construction of the sludge transfer system may create fugitive dust. Dust in work areas will be controlled using the application of water via trucks or hoses, as appropriate.

Control of Air Emissions

Small diesel generators or pumps may be used during the remedial actions. Low sulfur diesel fuel will be used as Best Available Control Technology for Toxics.

PLANNING DOCUMENTATION

Sampling and Analysis Plans

Sampling and analysis plans used in this project are developed using the EPA *Guidance for Data Quality Objective Process*, EPA QA/G-4 (EPA, 2000) and include quality assurance processes in accordance with *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5 (EPA, 2001). SAPs have previously been developed for use in the collection of data to support characterization of debris to be removed from the K Basins and to characterize sludge. Additional SAPs or revisions to existing SAPs will be required during this project to further characterize sludge for treatment and to support operations and deactivation of the transfer and treatment equipment. New SAPs and revisions to existing SAPs are subject to review and approval by the EPA.

Debris Sampling and Analysis Plan

The *SAP for K Basins Debris* (FH, 2005b) identifies the sampling, analysis and measurements needed to characterize K Basin above water debris and below water debris that is removed from the water for on site disposal. The SAP focuses on performing sampling, measurements and analysis of various debris types for disposal at ERDF. The *SAP for K Basin's Debris* will be reviewed and revised as necessary for use in the characterization of debris generated during the decommissioning of the SSAPS and sludge transfer system.

If the debris cannot be treated to meet ERDF waste acceptance criteria, it will be transferred to a 200 Area waste management facility approved by EPA. Alternatives recognized in the ROD include the Central Waste Complex, Mixed Waste Trench, Low Level Burial Grounds, Waste Receiving and Processing facility, and T Plant.

Sludge Treatment & Interim Storage Sampling and Analysis Plan

A SAP for sludge treatment using the SSAPS will be developed. The characterization process will be based on the *Hanford Site Solid Waste Acceptance Criteria* (FH, 2006b) requirements for interim storage at the 200 Area, and other requirements from TBC Material (i.e., the WCPIP and RH TRAMPAC) necessary to prepare certifiable treated sludge waste stream(s). The SAP will also consider CH TRU waste certification program requirements. The sludge SAP will consider the quality assurance requirements as identified in Section 3.4.4 of this plan.

Treatability Studies

While the SSAPS treatment processes that will be used are not new technology, the hazards associated with the handling and processing of this waste into a form that is safer, are unique and may require additional characterization data to support establishing process operating parameters, documenting system safety, and developing other design and operability information. To collect such information, Treatability studies may be required. Treatability studies performed will be planned and conducted using guidance contained in EPA *Guidance for Treatability Studies under CERCLA* (EPA, 1992). Treatability studies are considered Secondary documents under CERCLA and will be submitted to the EPA for review per section 9.2.3 of the Tri-Party Agreement. .

Health and Safety Plan

The KBC Project maintains a written health and safety plan that addresses the scope of work identified in this remedial action work plan; the *K Basins Interim Remedial Action Health and Safety Plan* (FH, 2005d). The plan identifies the following:

- Description of the Work
- Health & Safety Program Description
- Project Organization
- Hazard Identification
- Hazard Mitigation & Control
- Training
- Personal Protective Equipment
- Medical Surveillance
- Monitoring
- Site Control
- Decontamination
- Emergency response
- Confined space
- Spill Containment program
- Pre-Entry Briefings
- Hazard Communication Program.

Waste Management Plan

The K Basins STP will treat and generate a variety of waste forms. Notably, RH TRU waste will be treated and packaged during the project as described in this plan. In addition the following waste forms may be generated during the operation or deactivation of the treatment system.

- Contact-handled (CH) TRU PCB remediation waste, such as dilute sludge heels treated through the SSAPS.
- Low level waste (LLW) or LLW PCB remediation waste (e.g., corrosion system condensate, treated sludge heels),
- Debris (LLW, mixed waste debris).

It is noteworthy that debris is defined in the *K Basins Interim Remedial Action ROD* as all solid waste generated from the removal of materials from the K Basins, excluding SNF, sludge and water. The qualitative definition of debris presented in the ROD should not be confused with the definition of debris as defined under the *Resource Conservation and Recovery Act* (RCRA) 40 CFR 268.2(g) which stipulates that debris is solid material exceeding 60 mm (2.34 in.). Waste designations of debris generated and decisions regarding the appropriate debris management will use the RCRA definition of debris in instances where that debris exhibits a hazardous or dangerous waste characteristic[6].

Sludge will be additionally managed as a PCB remediation waste.

Waste management processes used during this remedial action are described in the *Waste Management Plan for the K Basins Interim Remedial Action* (FH, 2005e). The plan identifies the substantive waste management requirements and the strategy for their implementation, the anticipated waste types and the 100 K CERCLA waste storage areas. The Waste Management Plan will be revised to reflect the wastes and storage areas identified in this RDR/RAWP.

Mitigation Action Plan

A mitigation action plan is prepared to provide project personnel with guidance in instances where remedial actions may disturb natural or cultural resources. Most activities in this remedial action take place either inside the KW Basin building or the CVDF. Activities that take place outside the buildings include;

- setup and operation of the sludge hose-in-hose transfer system between KW Basins and the CVDF,
- setup and operation of the cement silo at CVDF, and
- setup and operation of treated waste drum storage outside the CVDF.

These areas are within the footprint of previously disturbed areas of the 100 K Area. Therefore a mitigation action plan is not needed for this action.

Institutional Control Plan

The DOE-RL has developed a *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions* (DOE-RL, 2001c). The plan integrates the sitewide requirements and further specifies additional requirements for specific locations that were identified in RODs. Institutional controls will be implemented as described in this plan for OU 100-KR-2.

Spill Prevention and Response Program

Hazardous materials handled and used in this remedial action (e.g., sludge, diesel fuel for equipment) and wastes generated during the remedial action will be stored and handled in a safe manner to prevent spills. Handling of hazardous material or substances shall be in accordance with material safety data sheets for the material.

Inadvertent spills or releases of potentially hazardous materials (e.g., equipment fluids) will be subject to the substantive requirements contained in emergency plans. In the event of a spill, the

[6] There are no known listed debris or waste types at the K Basins.

emergency response provisions outlined in the project health and safety plan (FH, 2005d) will be activated.

REMEDIAL ACTION CHANGE MANAGEMENT

Implementation of the interim remedial action may require changes to the requirements set forth in the ROD (EPA 1999a) when unexpected wastes and/or site conditions are encountered. A remedial action change management process is therefore necessary to minimize the impacts of these unforeseen circumstances. Three types of changes may be specified in a ROD (EPA 1999c): nonsignificant or minor; significant; and fundamental.

Nonsignificant or minor changes fall within the normal scope of changes occurring during the remedial design and remedial action processes. These minor changes will be documented in a KBC Project post-decision project file. Nonsignificant changes do not impact the requirements of the ROD or the functional requirements of the design.

The other two types of changes affect compliance with the ROD or the functional requirements of the design:

- **Significant change.** Significant changes generally involve a change to a component of a remedy that does not fundamentally alter the overall cleanup approach as presented in the ROD. All significant changes will be addressed in an explanation of significant difference.
- **Fundamental change.** A fundamental change is one that involves appreciable change or changes in the scope, performance, and/or cost or may be a number of significant changes that together have the effect of a fundamental change. All fundamental changes will be addressed in a ROD amendment.

Changes in requirements specified in a ROD or ROD amendment, e.g. ARARs or TBCs for the off-site disposal of waste treated during this remedial action (i.e., sludge) will also be evaluated for impact to the project.

The KBC contractor project director is responsible for tracking all changes and obtaining appropriate reviews by KBC project staff. The project director will discuss the changes with DOE-RL. The DOE-RL will then discuss the required changes with the regulatory agencies. The EPA will make a determination of the significance of the change and appropriate documentation will follow based on the type of change.

Remedial action change management will be implemented as described above and in the *Tri-Party Agreement Action Plan*, Section 9.3, *Document Revisions.*

PROJECT CLOSURE

End Point Criteria

End point criteria identified in the *End Point Criteria for the K Basins Interim Remedial Action* (FH, 2005a) that apply to this aspect of the remedial action include:

- "Sludge has been treated and packaged into a waste form suitable for off site disposal and shipped off Hanford to disposal."

Attaining milestones for shipment of treated sludge off Hanford for disposal will occur in the future after interim storage at T Plant and the Hanford RH TRU Program is certified by the DOE CBFO and EPA for shipment to the WIPP and waste has been shipped.

NOTE: As identified in Tri-Party Agreement Change Number M-034-04-01, "remedial action for the 100-K Area is not complete until shipments for disposal off site have taken place."

CLOSURE VERIFICATION

Closure verification will be performed by the KBC Project contractor to determine if remedial action objectives have been met and if secondary wastes generated during the sludge treatment and deactivation of the transfer and treatment equipment has been disposed of, and that the CVDF has been decontaminated to acceptable levels. Upon successful completion of the verification by the KBC Project contractor, notification will be made to the DOE-RL.

PROJECT CLOSURE DOCUMENTATION

A final Project Closure Report will be prepared as described in the *RDR/RAWP for the K Basins Interim Remedial Action* (DOE-RL, 2001a), Section 5.2. Project record files documenting that sludge has been treated and packaged into a waste form suitable for off site disposal (i.e., AK documentation developed during this remedial action) will be referenced in the Project Closure Report to satisfy the end point criterion documentation (*End Point Criteria for the K Basins Interim Remedial Action*, Section 3.0).

The following records[7] associated with the treatment of sludge will be archived in project record files and will be referenced in the Closure Report to document that activities were performed under the QA Program requirements identified in the WIPP WCPIP, Section 3.4.3, *Equivalent QA Program* for use in future qualification of the data under a certified RH TRU Program:

- Evidence that the organization performing the work identified persons or organizations responsible for verifying quality with sufficient independence from cost and schedule considerations (e.g., organizational charts and QA policies)
- Training records for waste characterization and verification personnel
- Assessment records (audits and surveillances)
- Nonconformance and corrective action records

[7] DOE/WIPP-02-3214, *Remote-Handled Transuranic Waste Characterization Program Implementation Plan for the Waste Isolation Pilot Plan*, Section 4.3.4, Equivalent QA Program.

- Procurement documentation for items and services that could affect the quality of the characterization data
- Approved QA plans and programs
- Standard operating procedures used for characterization and QA activities
- Document control records that demonstrate that documents were reviewed and approved in accordance with procedural requirements
- Calibration records
- Software qualification records
- Documented and verifiable evidence that a records program was in existence that required records important to quality be controlled, stored, maintained and retrievable.

Future waste shipment records for the shipment of treated sludge to the WIPP will be used to document off Hanford disposal.

REFERENCES

BHI, 2002, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, BHI-00139, Rev 4, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2003, *Supplemental Waste Acceptance Criteria for Bulk Shipments to the Environmental Restoration Disposal Facility*, BHI 0000X-DC-W0001, Rev. 5, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 1997, *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan*, DOE/RL-97-56, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1999, *Focused Feasibility Study for the K Basins Interim Remedial Action*, DOE/RL-98-66, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2001a, *Remedial Design Report and Remedial Action Work Plan for the K Basins Interim Remedial Action*, DOE/RL-99-89, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2001b, DOE-RL, P.G. Loscoe, DOE-RL to D.R. Sherwood, EPA and M.A. Wilson, Department of Ecology, *Completion of Designation for K Basins Sludge Waste Streams*, March 2001, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2001c, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions*, DOE-RL-2001-41, Rev. 0, July 2002, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2005a, *Remedial Design Report and Remedial Action Work Plan for the K Basins Interim Remedial Action: Supplement 2: K East Basin North Loadout Pit Sludge Treatment*, DOE/RL-99-89, Rev. 1, June, 2005, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2005b, *Addendum to the Focused Feasibility Study for the K Basins Interim Remedial Action*, DOE/RL-98-66, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2006, *Engineering Evaluation/Cost Analysis for the 105-KE and 105-KW Reactor Facilities and Ancillary Facilities*, DOE/RL-2005-86, Rev. 0, May 2006, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/WIPP, 2002, *RH TRU 72-B Cask Safety Analysis Report*, Rev. 3, Appendix 1.3.7, *Remote-Handled Transuranic Waste Authorized Methods for Payload Control* (RH TRAMPAC), U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

DOE/WIPP, 2003, *Remote-Handled Transuranic Waste Characterization Program Implementation Plan for the Waste Isolation Pilot Plan,* DOE/WIPP-02-3214, Rev. 0D, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

DOE/WIPP, 2005 , DOE/WIPP-02-3122, *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* Rev. 4, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

EPA, 1990, EPA *Guidance on Expediting Remedial Design and Remedial Action,* EPA/540/G-90/006, U.S. Environmental Protection Agency, Washington, DC.

EPA, 1992, EPA *Guidance for Treatability Studies under CERCLA*, EPA/540/G-92-071a, Environmental Protection Agency, Washington, DC.

EPA, 1999a, *Record of Decision for the K Basins Interim Remedial Action*, EPA/ROD/R10-99/059, U.S. Environmental Protection Agency, Richland, Washington.

EPA, 1999b, *Interim Action Record Of Decision: 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6 AND 200-CW-3 Operable Units,* EPA/ROD/R10-99/039, U.S. Environmental Protection Agency, Richland, Washington.

EPA, 2000, *Guidance for Data Quality Objective Process*, EPA QA/G-4, EPA/600/R-96/055, U.S. Environmental Protection Agency, Washington, DC.

EPA, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, EPA/240/B-01/003, Washington, DC.

EPA, 2005, *ROD Amendment for the K Basins Interim Remedial Action,* U.S. Environmental Protection Agency, Richland, Washington.

FH, 2005a, *End Point Criteria for the K Basins Interim Remedial Action*, HNF-20632, Rev. 0, Fluor Hanford, Richland, Washington.

FH, 2005b, *Sampling and Analysis Plan for K Basin's Debris,* HNF-6495, Rev. 2A, Fluor Hanford, Richland, Washington.

FH, 2005c, *K Basins Closure Project Execution Plan*, KBC-23617, Fluor Hanford, Richland, Washington.

FH, 2005d, *K Basins Interim Remedial Action Health & Safety Plan*, HNF-4747, Rev. 4, Fluor Hanford, Richland, Washington.

FH, 2005e, *Waste Management Plan for the K Basins Interim Remedial Action* SNF-9430, Rev. 2, Fluor Hanford, Richland, Washington.

FH, 2006a, *Spent Nuclear Fuel Project Technical Databook*, HNF-SD-SNF-TI-015, Volume 2 Sludge, Revision 13, January 2006, Fluor Hanford, Richland, Washington.

FH, 2006b, *Hanford Site Solid Waste Acceptance Criteria,* HNF-EP-0063, Fluor Hanford, Richland, Washington.

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Remedial Design Report for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage

Phase 3: Sludge Assay and Solidification

Prepared for the U.S. Department of Energy
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Remedial Design Report for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage Sludge Treatment and

Phase 3: Sludge Assay and Solidification

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EXECUTIVE SUMMARY – PHASE 3

The K Basins sludge treatment project is described in the *Remedial Design Report / Remedial Action Work Plan (RDR/RAWP) for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage* (DOE-RL, 2006). The remedial design is presented in five phases. This document summarizes the details of the remedial design for Phase 3 – *Sludge Assay and Solidification.* Phase 3 includes:

- Assaying of sludge to ensure the appropriate proportions of sludge and cement are metered into waste drums to ensure treated waste meets current radiological packaging, interim storage and disposal facility requirements,
- Mixing and solidification of sludge in 55-gallon containers,
- Actions during processing to document acceptable knowledge in preparation for interim storage and eventual disposal at the Waste Isolation Pilot Plant (WIPP), and
- Accumulation and interim storage of stabilized and packaged waste inside and outside the CVDF prior to shipment to T Plant.

Additional phases of the project include the following:

- Phase 1 – Transfer of Sludge from the KW Basin to the CVDF
- Phase 2 – Corrosion of Sludge
- Phase 4 – Treated Sludge Interim Storage at T Plant and Disposal
- Phase 5 –Transfer and Treatment Equipment Deactivation

The document includes a description of the Applicable or Relevant and Appropriate Requirements (ARARs) and other criteria, advisories, or guidance to-be-considered (TBC) that apply to the Phase 3 scope of work and the remedial design. Phase 3 of the remedial design describes the Assay System, the Mobile Solidification System (MOSS), the drum handling system of the Sludge Solidification and Packaging System (SSAPS), and the lag storage area at CVDF for drums of stabilized waste.

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ACRONYMS

ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirements
AK	Acceptable Knowledge
CCTV	Closed-Circuit Television
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH	Contact-Handled
Ci	Curies
CVDF	Cold Vacuum Drying Facility
DOE	Department of Energy
DQO	Data Quality Objective
EPA	Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FGE	Fissile Gram Equivalent
GTCC	Greater Than Class C
IPAN	Imaging Passive Active Neutron
KBC	K Basins Closure
KE	K East
KOP	Knock-Out-Pot
KW	K West
LLW	Low-Level Waste
MOSS	Mobile Solidification System
NDA	Nondestructive Assay
NLOP	North Loadout Pit
PCB	Polychlorinated Biphenyl
PK	Process Knowledge
ppb	Parts per billion
ppm	Parts per million
QAO	Quality Assurance Objective
QA/QC	Quality Assurance / Quality Control
RBDA	Risk-Based Disposal Approval
RDR/RAWP	Remedial Design Report / Remedial Action Work Plan
RH	Remote-Handled
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SSAPS	Sludge Stabilization and Packaging System
STP	Sludge Treatment Project
TBC	To-be-considered
TMU	Total Measurement Uncertainty
TRAMPAC	Transuranic Waste Authorized Methods for Payload Control
TRU	Transuranic
TRUCON	Transuranic Content Codes
UN	United Nations

VE	Visual Examination
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria
WCPIP	Waste Characterization Program Implementation Plan (Remote-Handled TRU)
WIPP	Waste Isolation Pilot Plant

DEFINITIONS

Acceptable Knowledge (AK). Information about the waste based on the material and processes that generated the waste and the procedures and policies that were used to package and manage the waste. AK includes, but is not limited to, information about the physical form of the waste, the base materials composing the waste, the radiological characteristics of the waste, and the process that generated the waste. AK includes any documentation that describes or verifies site history, mission, and operations, in addition to waste stream-specific information used to define the generating process, matrix, and contaminants (radiological and chemical).

Nondestructive Assay (NDA). Nondestructive Assay is a term used to define methods for determining the radionuclide content of the waste without destroying or changing the waste form chemically or physically. NDA, in conjunction with AK, can be used to establish Transuranic (TRU) activity, total activity, isotopic activity, and activity per canister. NDA is used in conjunction with AK information or a documented study that provides the needed relationship between NDA and the isotopic characteristics of the waste.

PCB remediation waste. PCB remediation waste means waste containing PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations: Materials disposed of prior to April 18, 1978, that are currently at concentrations ≥ 50 ppm PCBs, regardless of the concentration of the original spill; materials which are currently at any volume or concentration where the original source was ≥ 500 ppm PCBs beginning on April 18, 1978, or ≥ 50 ppm PCBs beginning on July 2, 1979; and materials which are currently at any concentration if the PCBs are spilled or released from a source not authorized for use under this part. PCB remediation waste means soil, rags, and other debris generated as a result of any PCB spill cleanup, including, but not limited to:

(1) Environmental media containing PCBs, such as soil and gravel; dredged materials, such as sediments, settled sediment fines, and aqueous decantate from sediment.

(2) Sewage sludge containing < 50 ppm PCBs and not in use according to Sec. 761.20(a)(4); PCB sewage sludge; commercial or industrial sludge contaminated as the result of a spill of PCBs including sludges located in or removed from any pollution control device; aqueous decantate from an industrial sludge.

(3) Buildings and other man-made structures (such as concrete floors, wood floors, or walls contaminated from a leaking PCB or PCB-Contaminated Transformer), porous surfaces, and non-porous surfaces.

Process Knowledge (PK). Process knowledge refers to applying knowledge of the waste in light of the materials or processes used to generate the waste. PK is detailed information on the wastes obtained from existing published or documented waste analysis data or studies conducted on wastes generated by processes similar to that which generated the waste. PK may include information on the physical, chemical, and radiological properties of the materials associated with the waste generation process(es), the fate of those materials during and subsequent to the process, and associated administrative controls. PK commonly includes detailed information on the waste obtained from existing waste analysis data, review of waste generating process(es), or detailed information relative to the properties of the waste that are known due to site-specific and/or process-specific factors.

Remote-Handled (RH) Waste. Waste with a surface dose rate of 200 mrem/hr or greater.

Sludge. Sludge is any material in the K Basins water that will pass through a screen with 0.25 in. (.64 cm) openings. Sludge on the floor and in the pits is a mix of fuel corrosion products (including metallic uranium, and fission and activation products), small fuel fragments, iron and aluminum oxide, concrete grit, sand, dirt, operational debris, and biological debris.

Transuranic (TRU) Waste. Waste containing greater than 100 nCi/g of alpha-emitting TRU radionuclides with half-lives greater than 20 years.

INTRODUCTION – PHASE 3

PURPOSE and scope

The purpose of this Remedial Design Report (RDR) is to describe the remedial design and the design basis for Phase 3, *Assay and Solidification* of the K Basins sludge treatment project (STP) described in the *Remedial Design Report / Remedial Action Work Plan (RDR/RAWP) for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage* (DOE-RL, 2006). The K Basins sludge is being removed from the 105-K East (KE) Basin (Operable Unit 100-KR-2, Site 100-K-42) and 105-K West (KW) Basin (Operable Unit 100-KR-2, Site 100-K-43) per the *Record of Decision (ROD) for the K Basins Interim Remedial Action* (EPA, 1999). The sludge is a remote-handled (RH) transuranic (TRU) PCB remediation waste and will be treated for disposal at DOE's Waste Isolation Pilot Plant (WIPP), a geologic repository, as described in the *ROD Amendment for the K Basins Interim Remedial Action* (EPA, 2005).

The scope of this remedial action addresses the balance of sludge. Sludge retrieved from the KE North Loadout Pit (NLOP) to Large Diameter Containers is treated under a separate remedial design (DOE-RL, 2005) and is not included in the scope of this RDR.

The remedial design for the K Basins STP includes a system to remove the sludge from KW Basin containers and vessels, a hose-in-hose system to transfer sludge to the Cold Vacuum Drying Facility (CVDF), and sludge stabilization and packaging system (SSAPS). Sludge stabilization and packaging includes evaporation (concentration), corrosion of uranium using a high temperature water oxidation process, assaying of corroded sludge to determine sludge radiological loading limits for solidification, and packaging of corroded sludge in cement. Processing will be carried out in equipment located in Bays 1 and 2 of CVDF using existing facility infrastructures to the extent practicable (Figure 1-1). The containers of stabilized and packaged sludge will then be accumulated in Bay 3, loaded into casks outside the CVDF and shipped to T Plant for interim storage pending ultimate disposition at the WIPP. Sludge will be packaged in the SSAPS to optimize the payload and minimize the number of containers, while maintaining a safe retrieval, transport and interim storage configuration (i.e., critically safe, thermally stable, non-explosive atmosphere). The final packaging containers for stabilized sludge are 55-gallon drums.

The main components of the SSAPS include:

- treatment of uranium metal fines and metal hydrides in the sludge using a high temperature water oxidation process to ensure uranium is not pyrophoric or reactive and will not generate hydrogen gasses above acceptable levels,
- the Assay System (i.e., Imaging Passive Active Neutron [IPAN] system to determine container radiological loading limits),
- a Mobile Solidification System (MOSS),
- cleaning and verification technician inspection station,
- drum handling system,
- lag storage system for containers of stabilized sludge,
- cement supply tank and feed system,

- concrete shielding around process equipment, and
- control facilities.

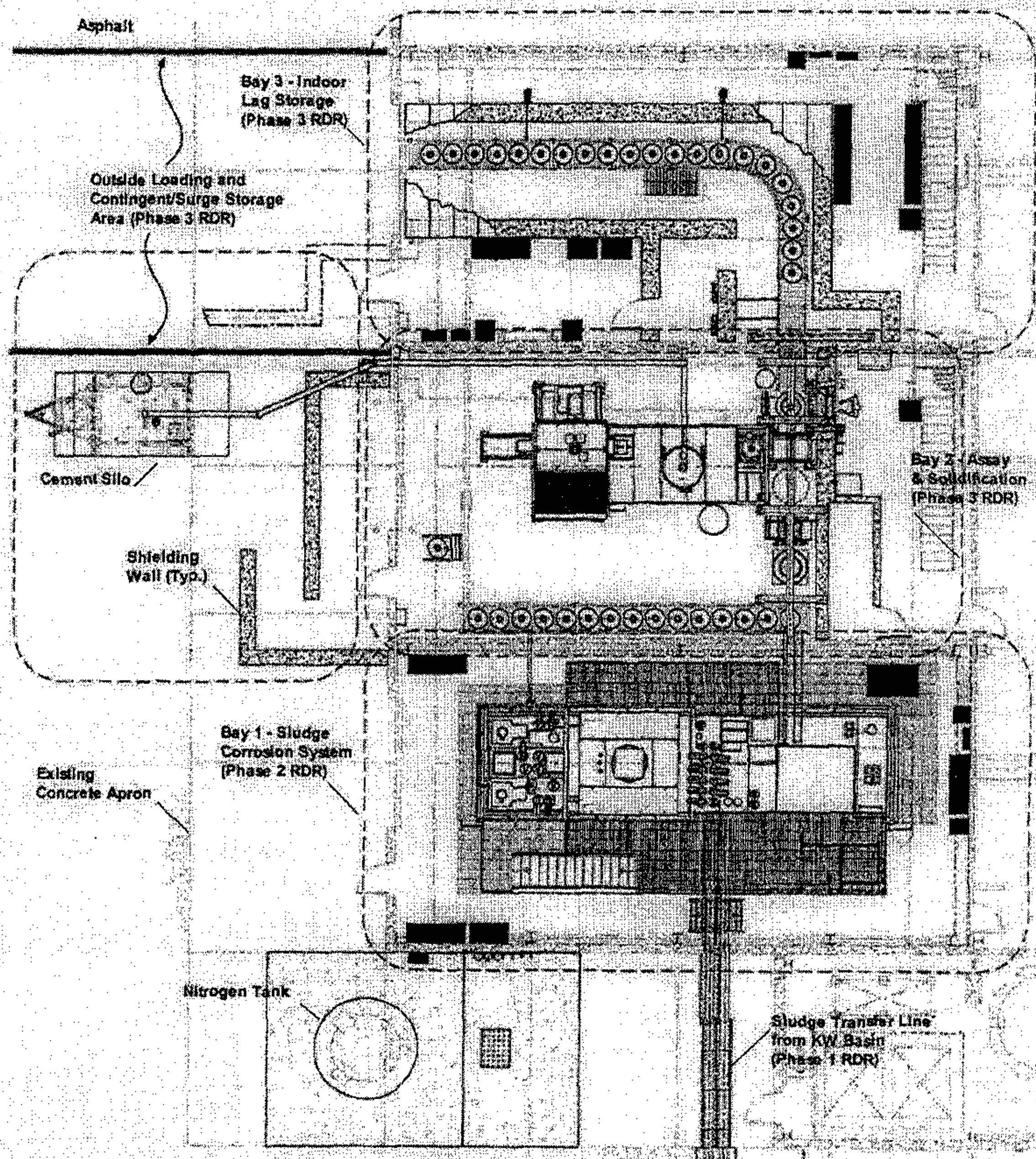

Figure 1-1. Sludge Stabilization and Packaging System – Floor Plan

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REMEDIAL DESIGN – PHASE 3

Phase 3 of the remedial design describes the Assay System, the MOSS and the drum handling system of the SSAPS and the lag and contingent/surge storage areas at the CVDF for drums of stabilized waste. The Assay System and MOSS will be installed as skid mounted systems in Bay 2 of the CVDF (Figure 2-1). The lag storage area will be located in Bay 3 (Figure 2-2). A loading and contingent/surge storage area is located outside of the CVDF.

The Assay System is designed to receive corroded sludge in a vessel wherein radionuclide characteristics are determined using an IPAN system. Thereafter sludge is metered to the MOSS system where it is combined with cement and makeup water in a 55-gallon drum and mixed to produce a homogenous solid waste form. The general arrangement of the Assay System and MOSS is depicted in Figure 2-3.

The Assay System; the MOSS; and the drum handling system and lag and contingent/surge storage areas are described separately below. The cement day tank and feed system that support operation of the MOSS are described with the MOSS. Related process control systems for the equipment are described within each section. External systems including the Corrosion Vessel, the external cement silo, and equipment shielding and interfaces with the sludge corrosion system and the CVDF centralized ventilation system are summarized separately at the end of the section.

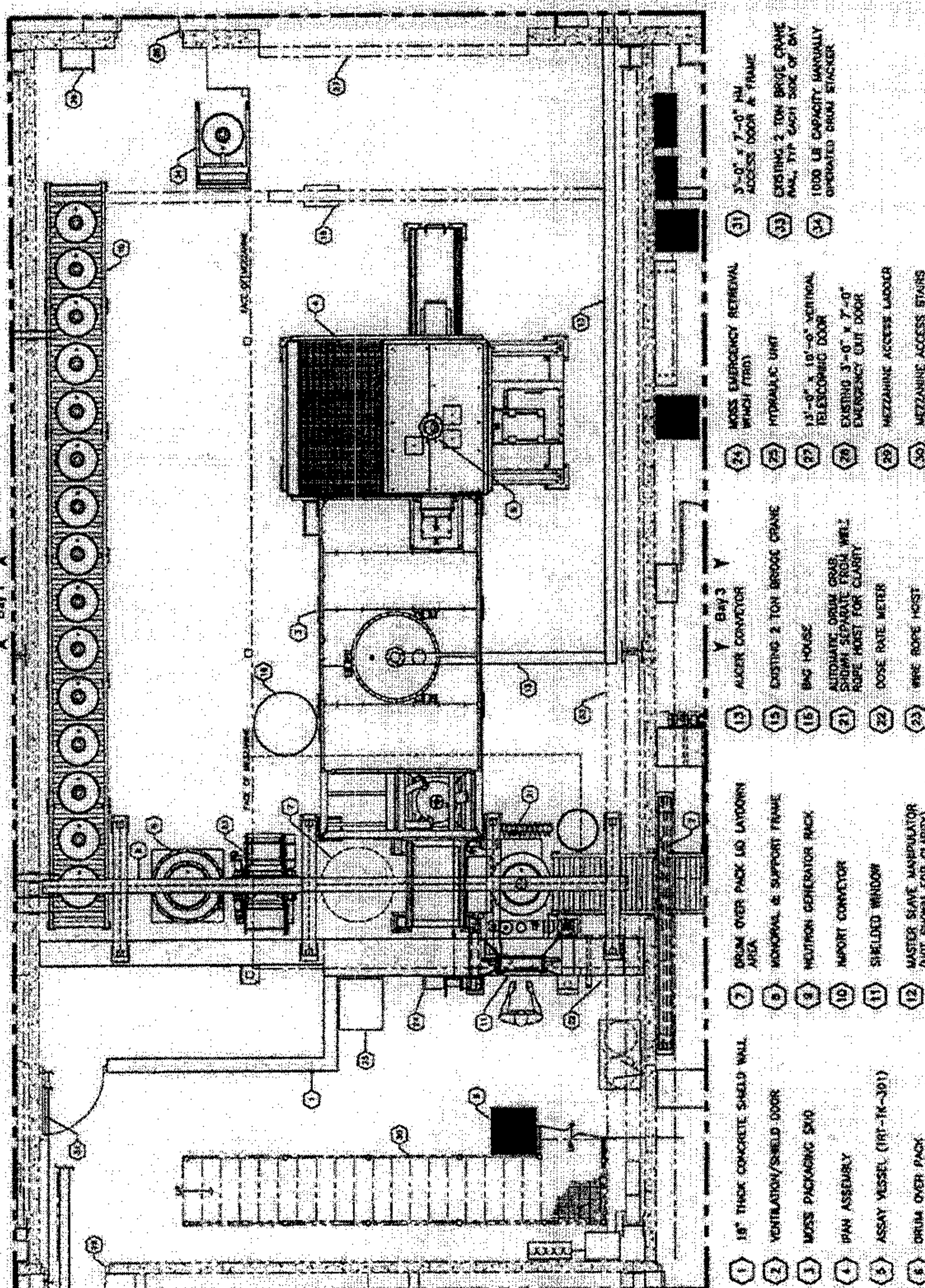

Figure 2-1. Bay 2 - Assay System and MOSS - Floor Plan

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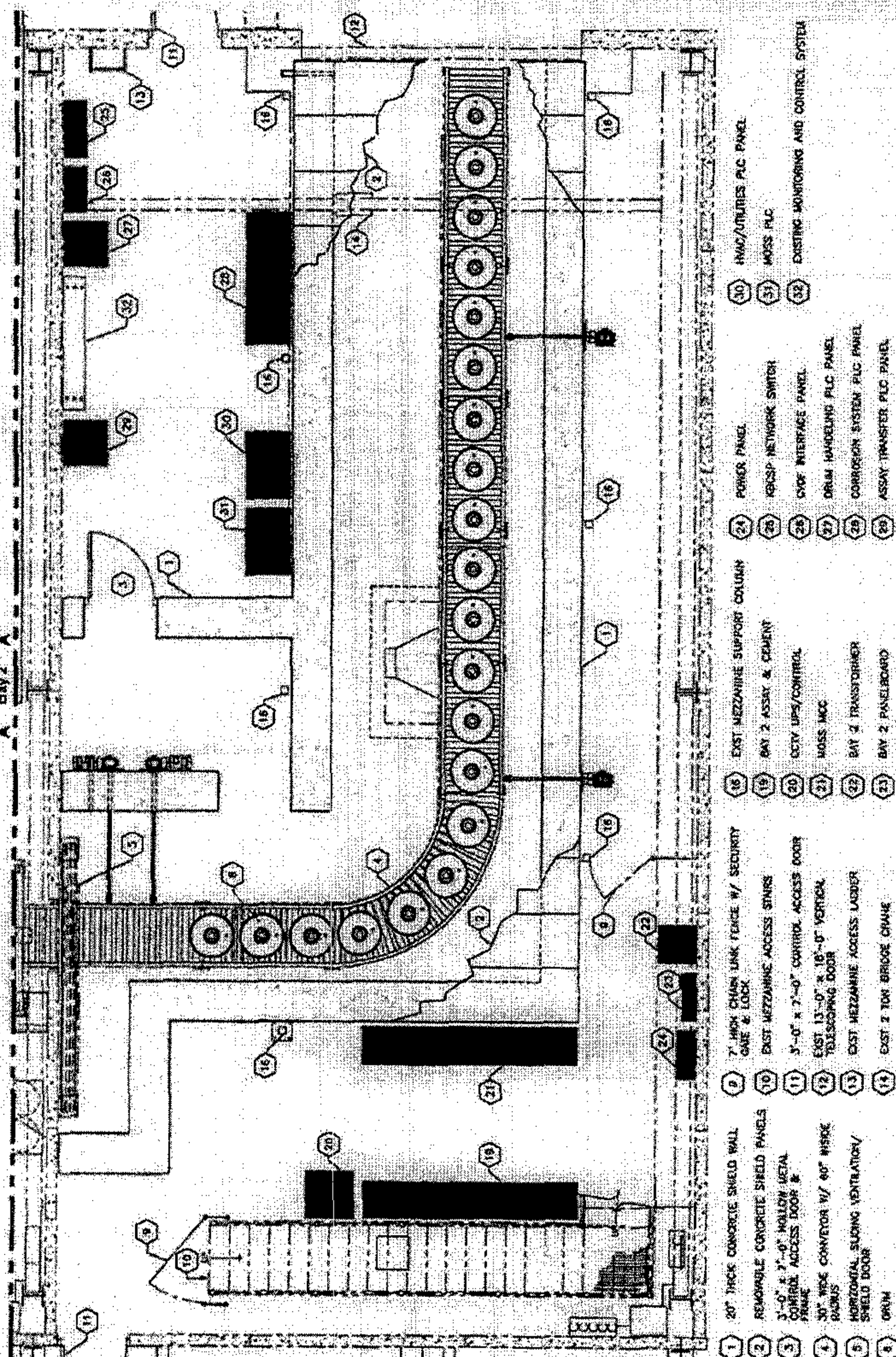


Figure 2-2. Bay 3 – Lag Storage Area - Floor Plan

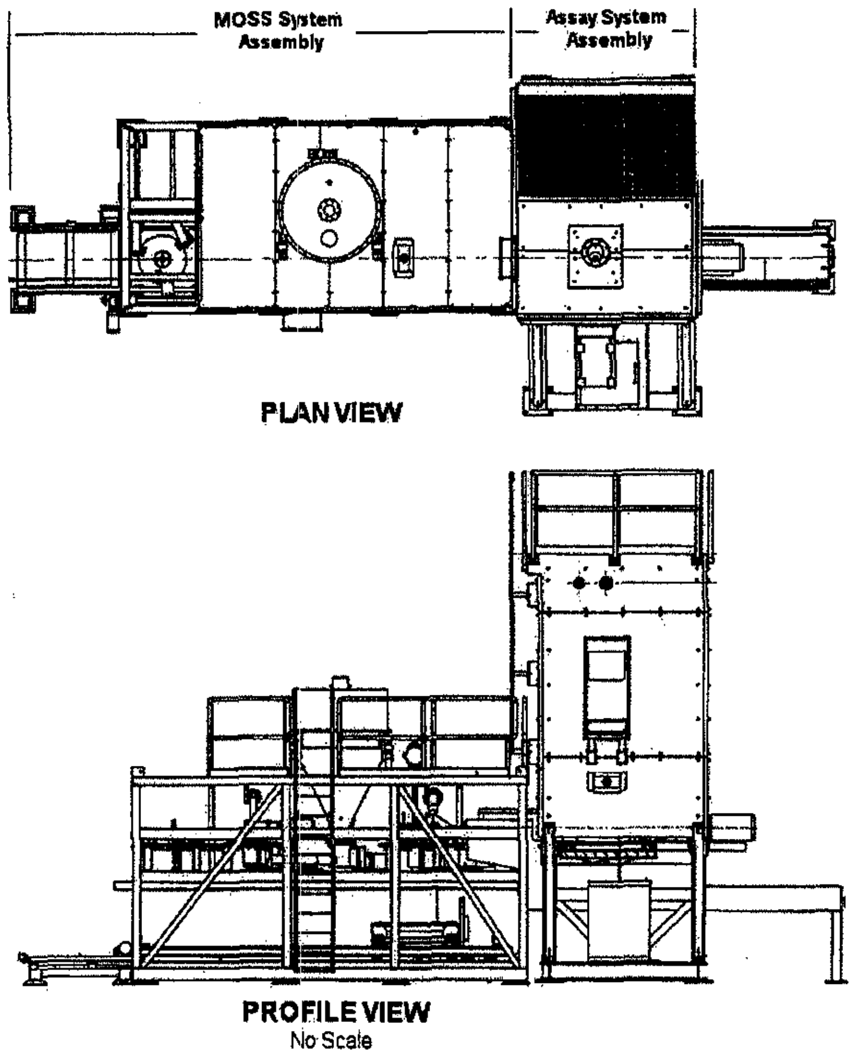


Figure 2-3. Assay System and MOSS – General Arrangement

Assay System

The Assay System is designed to assay corroded sludge received in batches from the Corrosion Vessel (TRT-TK-201) and meter it to the solidification and packaging system (i.e., MOSS). Primary components of the Assay System include: an Assay Vessel (TRT-TK-301), a mechanical agitator within the Assay Vessel that operates continuously during all modes of operation, an IPAN system to determine radiological characteristics, level instrumentation and an Assay Vessel discharge pump (TRT-P-301) that meters sludge to the MOSS for solidification and packaging. The arrangement of the Assay System and components are depicted in Figure 2-4. The primary components of the Assay System and process flow are summarized in Figure 2-5.

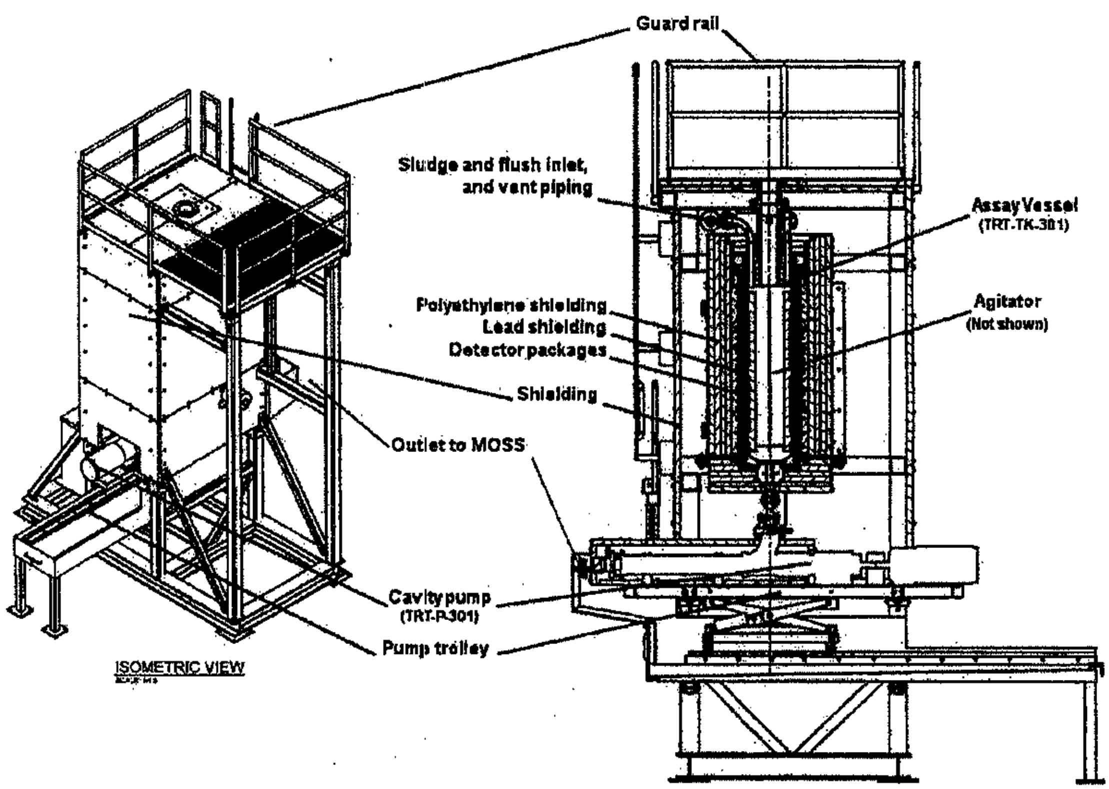


Figure 2-4. Assay System - General Arrangement

The Assay System is designed to use a combination of active neutron interrogation and passive neutron coincidence counting which provides measures of both the ^{239}Pu effective and ^{240}Pu effective masses of sludge in the Assay Vessel and gross gamma measurement to determine ^{137}Cs activity of sludge in the Assay Vessel. Data obtained is used with existing process knowledge (PK) information to scale the activity of remaining radionuclides in the sludge. Data generated is used to develop sludge container loading volumes that meet FGE, container dose rate, TRU alpha activity and total curie requirements for the treated sludge. The assay system also identifies the FGE total measurement uncertainty (TMU) associated with each Assay Vessel batch and supports acceptable knowledge (AK) information development requirements.

The Assay Vessel has a nominal capacity of 50-gallons. The working volume of the Assay Vessel is approximately 38-gallons. The Assay Vessel is equipped with a drip pan that has a capacity of approximately 180 gallons. The Assay Vessel drip pan drains to the MOSS drip pan (~120 gallons). These drip pans provide secondary containment for the Assay Vessel and MOSS in excess of the twice the capacity of the single largest vessel or drum. The drain line from the assay drip pan is equipped with leak detection that triggers an alarm on contact with liquid. Piping from the Corrosion Vessel to the Assay Vessel is provided with secondary containment (hose-in-hose) which in the event of a leak would drain back to the adjacent vessel secondary containment system. The Assay Vessel and associated piping cannot be directly viewed, although the MOSS is equipped with closed circuit television (CCTV) as described in Section 2.2.

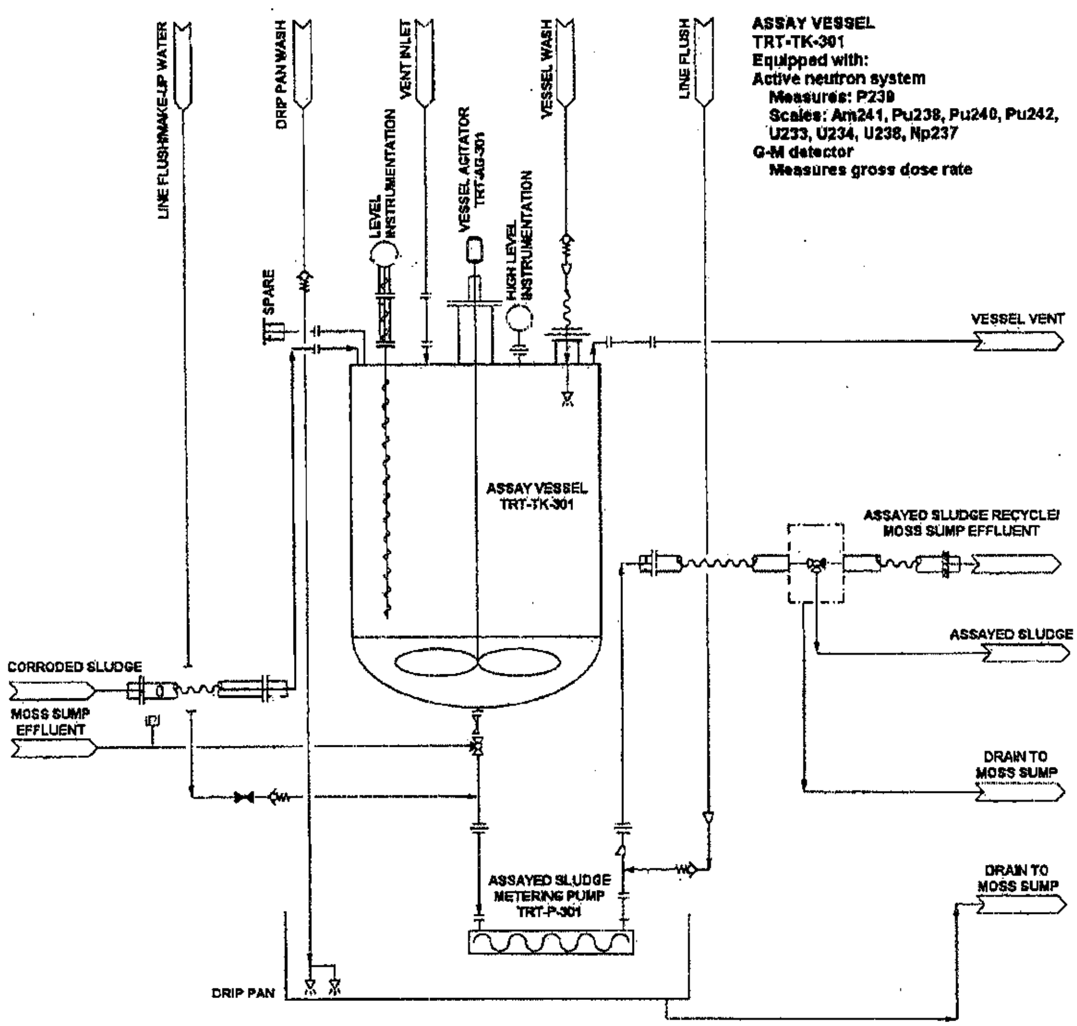


Figure 2-5. Assay System - Primary components and process flow

The Assay Vessel (TRT-TK-301) has three normal modes of operation: receipt, assay, and discharge. One mode of operation cannot occur while another is in progress and TRT-TK-301 does not receive another batch until it is completed emptying its contents.

Receipt Mode

During normal operations, vessel TRT-TK-301 receives multiple batches of corroded sludge from TRT-TK-201. Receipt of batches continues until TRT-TK-201 has reached its low level (heel volume). The batch volume of TRT-TK-301 is limited to a volume less than a drum to prevent overfilling a drum with sludge.

The inlet line into TRT-TK-301 is equipped with a coriolis meter to determine the total mass and density of the transferred corroded sludge. These parameters are required to determine the FGE content of the sludge.

Overfilling of the TRT-TK-301 is prevented by level control in the vessel. The control signals of the vessel level control system are:

1. Permissive signal to indicate there is sufficient receipt capacity to allow a sludge transfer to be initiated.
2. Control level setpoint that indicates the sludge receipt capacity has been reached, the sludge transfer stopped, and the line flush should be initiated.
3. High level setpoint that indicates the vessel capacity has been reached and all inflows to the vessel should be stopped (in the normal case this is the line flush).
4. A safety acting high-high level trip to prevent vessel overfill, which stops the transfer pump.

Assay Mode

The project is required to determine radionuclide activities including the activities and masses of ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr and ^{137}Cs in the sludge (and any other isotope that contributes greater than 1% to FGE or to the total curie content of the container), either by direct measurement or by calculation to meet the requirements of the RH TRAMPAC, WIPP WCPIP and the *Hanford Site Solid Waste Acceptance Criteria* (FH, 2006a).

The sludge is assayed using the IPAN system. To ensure a representative batch during IPAN measurements, the sludge is kept in suspension using an agitator.

The IPAN system uses a combination of active neutron interrogation and passive neutron coincidence counting to determine the FGE of each Assay Vessel volume of sludge. The active neutron interrogation produces a measure of the fissile material within the Assay Vessel. Analysis of the passive neutron coincidence signal provides a measure of the mass of spontaneous-fission emission material within the Assay Vessel. The system therefore provides measures of both the ^{239}PU effective and ^{240}PU effective masses for each vessel of sludge.

The IPAN system is comprised of a shielded cavity that surrounds the Assay Vessel on all four vertical sides with no top or bottom. Polyethylene shielding is used where possible on the top and bottom to provide a neutronic enclosure that reflects neutrons back into the cavity and a shield against background neutrons. Three sides of the assay cavity contain ^{3}He detector packages and polyethylene shielding while the fourth contains a neutron generator (See Figures 2-6 and 2-7). The IPAN system includes a gross gamma measurement to determine the ^{137}Cs activity in the sludge.

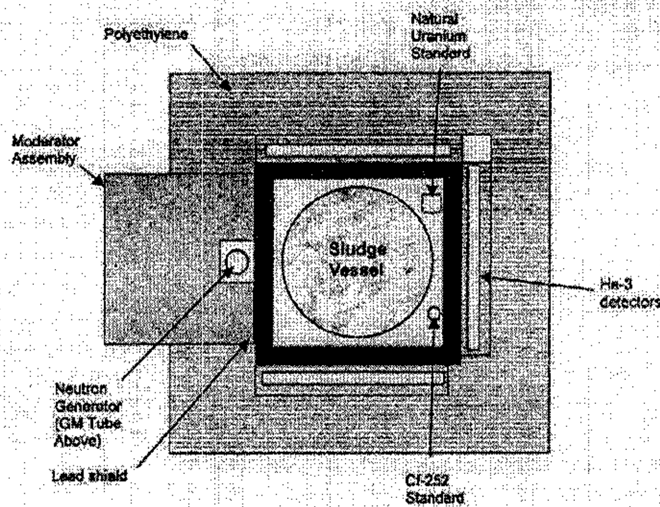


Figure 2-6. IPAN – Plan View (no scale)

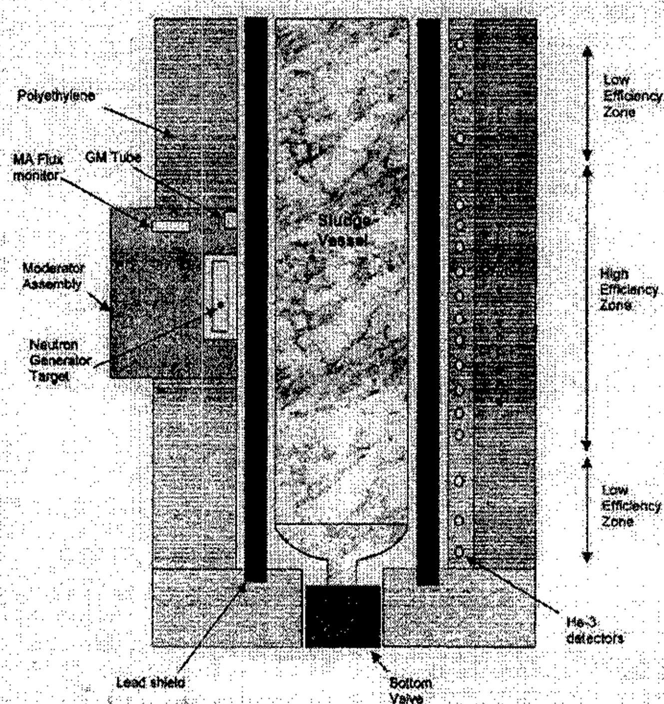


Figure 2-7. IPAN – Profile View (no scale)

The sludge is assayed and the volume of sludge that can be loaded into each 55-gallon waste drum is calculated by the Process Control System using data supplied by the IPAN and existing PK of the sludge. The maximum volume of sludge that may be loaded into a drum is determined as the minimum volume of one of the following:

5. Maximum volume of corroded sludge that can be accommodated in a 55-gallon drum, including allowance for cement addition to form a stabilized waste form.
6. Maximum ^{239}Pu FGE <200 grams (i.e., less than the maximum of 325 grams per RH TRU waste canister).
7. Maximum of 23 curies per liter total activity including two times the TMU expressed in terms of one standard deviation averaged over the volume of the waste drum.
8. Maximum surface dose rate limit of <100 rem/hr unshielded (up to 5% of the drums may be ≥100 rem/hr as long as no drum exceeds 200 rem/hr).
9. Maximum hydrogen generation in the final product container is such that the concentration of hydrogen in the innermost container (in this case the product drum headspace) cannot exceed 5%.

Discharge Mode

After determining the maximum sludge volume loading, the correct amount of sludge is metered from the Assay Vessel to the packaging system using a pump (TRT-P-301). A shaft encoder on the metering pump measures the volume delivered to a drum and stops the transfer of sludge once the predetermined volume has been transferred out of TRT-TK-301 to the drum.

The volume of sludge loaded into a drum can be less than the batch volume of TRT-TK-301. Therefore, one batch volume in TRT-TK-301 can lead to multiple batches transferred to the MOSS for stabilization and packaging. .

Each transfer to a drum is followed by a flush to clear the line and make-up water may be pumped via TRT-P-301 to achieve target water to cement ratios.

Background and standardization checks of the detector packages will be performed periodically. Details of quality assurance processes such as background and standardization checks will be described in sampling and analysis plans prepared to support the characterization. During operation, the system has the capability to route the sludge and/or flush water to either a drum or back to TRT-TK-201.

Mobile Solidification System

Sludge solidification and packaging will be performed using a MOSS designed to perform grout encapsulation and packaging of nuclear wastes. The function of the MOSS is to encapsulate the sludge by mixing it with ordinary Portland cement and packaging it into modified 55-gallon drums. Waste slurry, water and cement are dosed directly into a drum for mixing. The drum mixing procedure employs a "sacrificial stirrer" wherein each drum is pre-fitted with a mixing stirrer that is left in the drum after the mixing procedure and becomes incorporated into the treated waste matrix.

The sequence of operation of the MOSS is depicted in Figure 2-8 (*MOSS Primary components and process flow*) and includes the following:

10. A drum with lid installed (with installed stirrer) is positioned into the drum trolley at the Loading Position using a monorail supported drum lifting device (Position 1). All subsequent operations are carried out remotely with the assistance of Closed Circuit Television (CCTV).

11. The drum is moved to the Drum Fill Port Plug Handling Position where the drum lid fill port plug is removed and retained (Position 2).
12. The drum is then moved to the Wet Dosing Position where the drum is raised to engage the wet dosing head[1] (Position 3). Metered amounts of waste slurry from the Assay Vessel, flush water and make-up water are added through the waste feed pipe within the wet dosing head. The "recipe" for wet dosing will vary dependent on the waste sludge source and assay information.
13. The drum is moved to the Dry Dosing Position where the drum is raised to engage the dry dosing and mixing head (Position 4). The drum stirrer is engaged by a mechanical drive. Dry cement powder is added at an established feed rate to the drum and the mixture is stirred. The drum weighing system will monitor the cement addition process to ensure accurate quantities are fed for each recipe.
14. After mixing, the drum is returned to the Drum Fill Port Plug Handling Position where the center plug is re-installed in the drum lid (Position 5).
15. The trolley returns to the Loading Position where the sealed drum containing treated waste is removed from the MOSS system by the monorail system (Position 6).

The MOSS unit consists of six main mechanical subsystems:

16. MOSS Framework
17. Drum Subsystem
18. Drum Positioning Subsystem
19. Wet Dosing Subsystem
20. Dry Dosing and Mixer Drive Subsystem
21. Drum Fill Port Capping Plug Handling Subsystem.

In addition the MOSS includes control and monitoring systems and ancillary and external systems that support the solidification system. Each of these is described in the following subsections. The MOSS general arrangement is depicted in Figure 2-9.

[1] Both dosing heads are equipped with vent systems that connect to a centralized ventilation system to prevent radioactive aerosol diffusion to the drum surroundings and to the facility. (Both dry dosing and wet dosing heads are equipped with drip pans.)

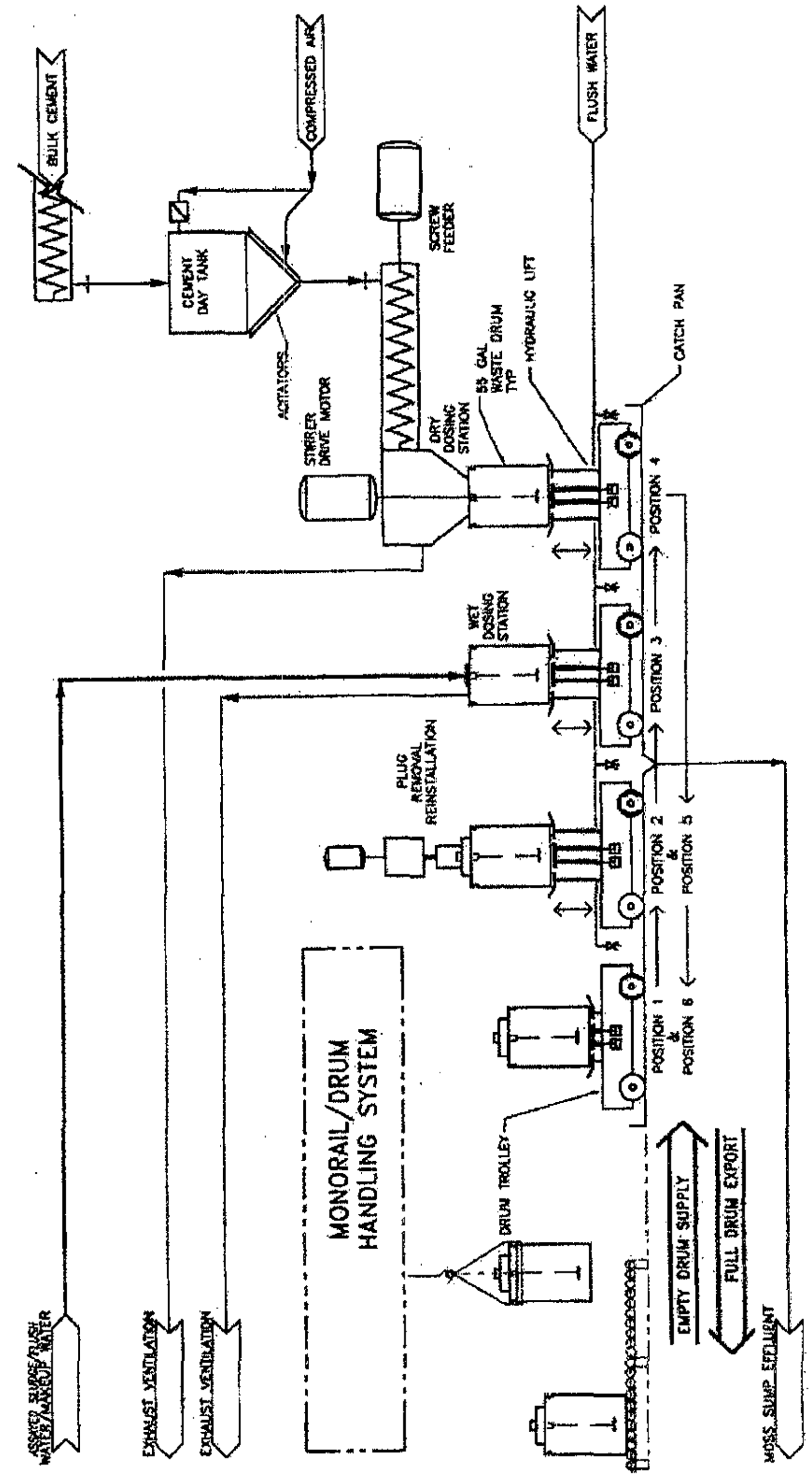
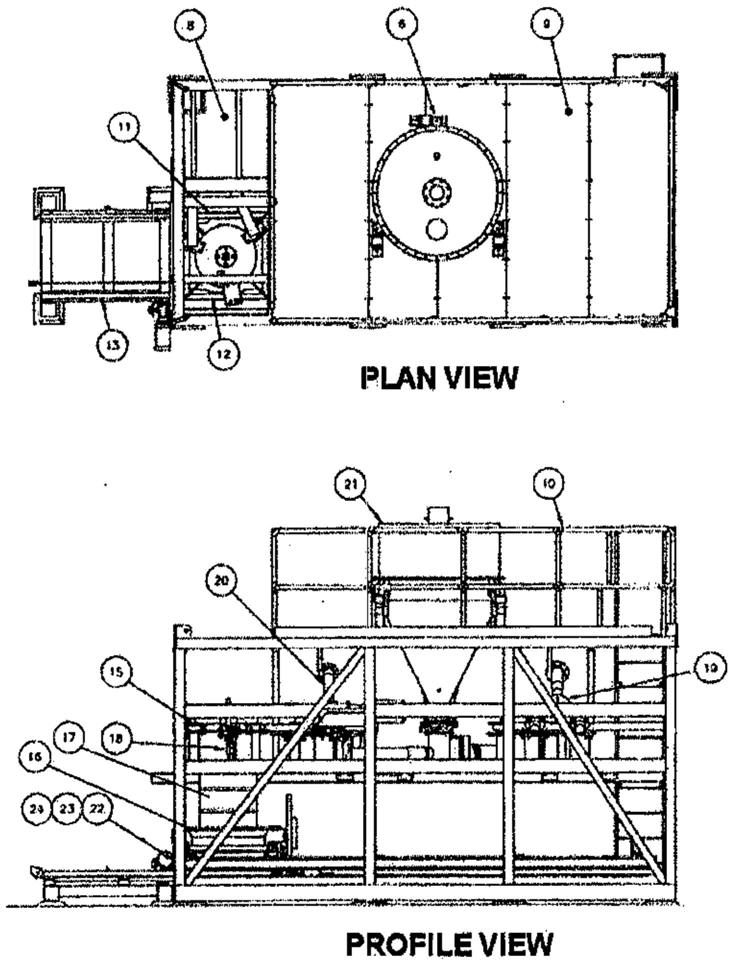


Figure 2-8. MOSS - Primary components and process flow



[illegible]	[illegible]
MOSS EQUIPMENT ARRANGEMENT	1
CEMENT TANK BRACKET ASSEMBLY	6
LOWER DECK GRATING ASSEMBLY	8
UPPER DECK FLOORING ASSEMBLY	9
UPPER DECK HAND RAIL & LADDER DETAILS	10
TROLLEY RAILS ASSSEMBLY (RECTANGULAR)	11
TROLLEY RAILS ASSEMBLY (ROUND)	12
TROLLEY RAIL FRAME EXTENSION ASSEMBLY	13
SKID EQUIPMENT INTERNAL SUPPORT ASSEMBLY	15
TROLLEY EQUIPMENT ASSEMBLY	16
MOSS DRUM ASSEMBLY	17
PLUG DRIVER ASSEMBLY	18
WET DOSING HEAD ASSEMBLY	19
DRY DOSING HEAD ASSEMBLY	20
CEMENT FEED SYSTEM ASSEMBLY	21
MOTOR ARM MOUNTING ASSEMBLY	22
ENCODER ADAPTER SHAFT DETAILS	23
ENCODER MOUNTING DETAILS	24

No Scale

Figure 2-9. MOSS - General Arrangement

Moss Framework

The MOSS unit is contained within a structural steel frame equivalent in size to a standard 20-foot Sea Land type container. Major mechanical components are mounted within the frame. A stainless steel catch pan is situated on the floor of the unit to collect potential drum spillage and facilitates eventual decontamination. The catch pan has a capacity of approximately 120 gallons. Releases from both the MOSS drip pan and the IPAN drip pan drain to the MOSS Sump. The Assay Vessel drain line is equipped with leak detection and the MOSS Sump is equipped with a liquid level alarm which is set to alarm when an accumulation of liquid is detected. Liquid collected in the MOSS Sump can be pumped either to the Corrosion Vessel (i.e., Assayed Sludge Recycle/MOSS Effluent) or to drums for stabilization (See Figure 2-5). In the event of leaks or spills to the MOSS, operations will be curtailed and residues of spilled or leaked material in the MOSS drip pan and sump will be cleaned up.

A trolley rail system runs along the length of the frame and extends to the outside of the frame at one end to accommodate the trolley drum loading position. Four lifting lugs are located on the top of the frame to allow for loading/unloading, movement and positioning of the MOSS unit by crane. A short extension of the frame supports the trolley positioning rails to allow the trolley to be positioned under the drum handing monorail system.

Drum Subsystem (Drum, Stirrer, Lid)

The MOSS unit is designed to handle standard DOT 7A carbon steel drums. Drums specified for treated sludge will be 55-gallon drums designed for United Nations (UN) 1A2 packing group I and DOT-7A for solids and UN1A2 packing group II for liquids. Each drum has a nominal volume of 55-gallons and is provided with a sacrificial mixing stirrer mechanism mounted within the drum (Figure 2-10). The mixing mechanism has two parts.

22. An axle spindle mounted at the bottom of the drum
23. A mixing mechanism (lost stirrer) mounted on the axle spindle. The mixing mechanism has paddles to mix the waste, make-up water and cement and a shaft to accept the stirrer drive pin.

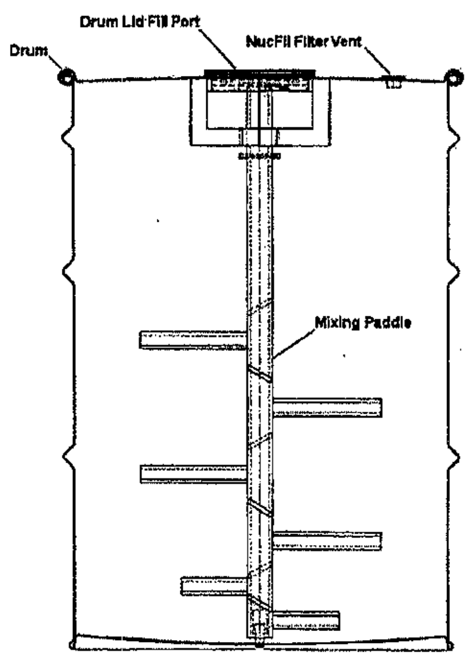


Figure 2-10. Drum Mixer Assembly

Prior to the MOSS receiving the drum, a stirring mechanism is installed in the drum and the drum lid is clamped in place with a standard compression band and tensioning/retaining bolt. The lid of the drum has two openings: a large opening is located in the center of the lid that is fitted with a threaded plug equipped with a NucFil® filter and a smaller opening, located near the

NucFil® is a registered trademark of Nuclear Filter Technology, Golden, Colorado outer ends of the lid is used to mount a second NucFil® filter. The specified NucFil® filters meet transportation requirements identified in the RH TRAMPAC (DOE/WIPP, 2002b) and storage requirements of the Hanford Site Solid Waste Acceptance Criteria. The large opening is used as a fill port to add the waste slurry with make-up water and cement. The mixing mechanism is operated through the opening.

Drum Positioning Subsystem

The Drum Positioning Subsystem consists of drum lift, scale, trolley drive, and a single manual recovery system. The trolley platform has guide plates to position and hold a single drum received at the Drum Loading Position. The platform is located on a rail-mounted trolley with integral scales and a hydraulic drum lift. The trolley is moved to one of the four positions by a motor-driven ball screw. In the event of mechanical failure, the ball screw can be disengaged and the trolley pulled using the emergency retrieval tow board by a remote cable winch to the drum loading/unloading position. The hydraulic lift is used to raise the drum upward to engage the vent hoods at the wet and dry dosing positions. The trolley lift facilitates engagement with the fill port plug removal/installation mechanism at the fill port plug handling station. In the event of a hydraulic failure, manual activation of dump valve located in the low radiation equipment room will cause the hydraulic cylinder to be drained to lower the lift. The integral load cells measure the weight of the drum and allow the monitoring of materials added to the drum at the wet and dry dosing positions.

Wet Dosing Subsystem

Addition of the waste slurry to the waste drums is performed using the wet dosing head. The wet dosing head is mounted on the MOSS unit over the trolley system and provides the interface between a single waste/water feed pipe and the waste drum. The waste drum is raised by the trolley using the trolley hydraulic lift to engage the wet dosing head. Wet dosing operations are viewed via CCTV and operated remotely from the STP control room.

The Wet Dosing Head Subsystem performs the following:

24. Transfer waste slurry mixed with make-up water to drum

25. Prevent airborne release of radioactive contamination

26. Contain radioactive residues when drum is not engaged.

Transfer Waste Slurry: The radioactive waste in the form of corroded uranium sludge mixed with make-up water is received via a shielded feed line from an independently supported Assay Vessel (TRT-TK-301) located adjacent to the MOSS system. The waste feed pipe passes through the wet dosing head and protrudes into the drum. The amount of waste transferred into the drum is based on the radionuclide inventory measured in the assay system. Control of the waste transfer volume will be via a metering pump on the Assay System which will be controlled by the Treatment System Programmable Logic Controller.

Flush and Make-up Water: After waste feed is completed, the Assay System will feed flush water and make-up water to the wet dosing head through the waste feed pipe. Flush and make-up water feed volume will be controlled by the Treatment System Programmable Logic Controller.

NucFil® is a registered trademark of Nuclear Filter Technology, Golden, Colorado

Drip Pan: A spill guard normally positioned underneath the wet dosing outlet will be retracted during the wet dosing operation. The pan collects potentially contaminated residues that might fall from the dosing head when a drum is not engaged.

Ventilation: The wet dosing subsystem includes exhaust hoods used to minimize the release of radioactive contamination to the CVDF process bay. One hood provides ventilation to the wet dosing head and one hood provides ventilation to the drip pan when it is retracted from under the wet dosing head. Engineered gaps are used between the drum and the vent hood and between the drip tray and vent hoods to maintain velocities required to capture and convey contaminants into the hood.

Drum Dry Dosing and Mixer Subsystem

The addition of dry cement and mixing of the treated waste is performed using the dry dosing head. The dry dosing head is mounted on the MOSS unit over the trolley system and contains a cement feed system, stirrer drive mechanism, and ventilation. The waste drum is raised from the trolley using the trolley hydraulic lift to engage the dry dosing head into the drum via fill port. Dry dosing and mixing operations are viewed via CCTV and operated remotely from the STP control room.

The Dry Dosing Head and Mixer Subsystem perform the following:

27. Transfers dry cement powder to the waste drum,

28. Turns the drum's internal mixing mechanism

29. Prevents the airborne release of radioactive contamination and cement dust

30. Contains radioactive residues when the drum is not engaged.

Cement Addition: Cement is added to the waste drum through the dry dosing head. The cement is transported from the cement day tank via a horizontal screw conveyor. The cement drops through the dry dosing head into the waste drum.

Stirrer Drive System: The stirrer drive system consists of a motor, a gearbox, a stirrer drive shaft, load cells and a stirrer drive position (elevations) switch. The stirrer drive speed control and the rotation are also controlled from the Variable Frequency Drive System. The stirrer unit is supported on load cells. These load cells are part of a scale with additional load cells on the trolley.

Drip Pan: A spill guard normally positioned underneath the dry dosing outlet will be retracted during dry dosing and mixing operations. The pan collects potentially contaminated residues that might fall from the dry dosing head when a drum is not engaged.

Ventilation: The dry dosing subsystem includes an exhaust hood that provides ventilation to minimize the release of cement dust or radioactive contamination to the process bay. An engineered gap is used between the drum and the vent hood and drip pan and vent hood to maintain velocities required to capture and convey contaminants into the hood.

Drum Lid Fill Port Plug Handing Subsystem

The Drum Lid Fill Port Plug Handing Subsystem removes and retains the center plug from the drum lid fill port after the drum is loaded into the MOSS Packaging System. The plug handling equipment mechanically and magnetically engages the plug and rotates the plug to unscrew it from the center opening. The plug is retained during drum filling operations by a magnetic capture feature on the rotating head. After the drum completes the wet and dry dosing operations, it is returned to the fill port plug handling position for reinstallation of the fill port plug. The plug is aligned and threaded to a set torque setting by the plug handling equipment. Plug removal and reinstallation operations are viewed via CCTV and operated remotely from the STP control room.

Control and Monitoring Systems

Closed Circuit Television

The CCTV subsystem is used for observing the positions of the drum and other activities associated with the process. MOSS has cameras equipped with Pan, Tilt and Zoom features as required to observe the mechanical actions of the MOSS. The display of the cameras can be selected from a multiplexer and keyboard located in the STP control room. The Pan, Tilt and Zoom function is also performed here. The monitor will display the camera image as the thumbnails and each thumbnail can be selected to be enlarged for viewing.

Computerized Control subsystem

The computerized control subsystem allows control of the process from a remotely located control room. This control room is shielded from the waste and drum radiation. Communication between the MOSS Packaging Skid and the control room is done by direct wiring. The controller and I/O-units are located in an enclosure local to the control room. The control system controls and monitors all remotely operated equipment in the MOSS systems.

Data Logging Subsystem

The MOSS Packaging System is equipped with a subsystem for data logging. A report is recorded for each finalized drum containing data of dosed amounts of waste, water and cement. Further data, such as cement dosing times, recipe number and run identification number are also recorded. The values of the recipe are also recorded as an aid for comparing and checking the actual values obtained from the process.

Ancillary Systems

Hydraulic Power System

The MOSS Packaging System contains a hydraulic power system that powers the trolley lift system. The hydraulic power unit is located outside the MOSS structure area in a shielded room. Connection to the trolley is via field-routed pipe or hosing.

Cement Day Tank

The cement day tank subsystem consists of an intermediate storage tank (day tank) of approximately 30 ft^3 volume, an outlet valve and a spiral screw feeder, which allows a slow and controlled dosing of cement to the drum.

The cement day tank will be filled intermittently by a spiral screw transport device from an external cement storage silo.

Dosing of cement into the waste drum is done in conjunction with operation of the mechanical drum mixing subsystem. Feedback from the cement day tank load cells, trolley load cells, and the duration of the screw feeder operation will all be used to control and verify the amount of cement fed into each drum dosing operation.

A spill guard normally positioned underneath the cement dosing outlet will be retracted during cement dosing and mixing operation.

The dry dosing head is ventilated through a bag-filter to collect dust prior to being routed to the vessel vent system and through the centralized ventilation system to the CVDF stack. The bag-filter is located within the CVDF.

Drum Handling and Storage

After the drum is filled and closed, the MOSS trolley places the full drum under the monorail hoist, where the drum handling device transports it to the decontamination area. In the decontamination area, the drum is lowered onto a turntable and the drum is swabbed using a master slave manipulator, operated and observed by the operator through the shield window. The bottom of drum is swabbed and wiped down prior to lowering the drum onto the turntable. Each used swab is placed in a shielded unit to be monitored for contamination. If a drum is contaminated, it must be decontaminated prior to export. This is accomplished using RadPro®, a patented commercial decontamination technology or similar decontamination products. The decontamination is performed in the monitoring station using the master slave manipulator.

Once the drum is determined to meet acceptable contamination levels, the drum is transferred by the monorail handling device to the export conveyor (Figure 2-2). The powered rollers of the export conveyor move the drum to lag storage in Bay 3 of the CVDF. A shield door located between Bay 2 and Bay 3 limits dose from the product drums awaiting collection. Bay 3 in CVDF includes storage capacity for up to 24 product drums on a roller conveyor. Shielding will be placed around the Bay 3 staging location to keep radiological exposure ALARA. Drums of treated sludge will remain in the CVDF for approximately 24 hours for curing.

Drums of solidified sludge will be removed from Bay 3 to the loading area outside the CVDF door (Figure 2-11). The loading area will be protected with shield blocks. Drums will be loaded in batches into 10-160B casks for transfer to T Plant. An empty cask(s) will be staged in the vicinity of the CVDF and prepared for loading. Drums will be loaded remotely using an installed gantry or portable crane. Once the cask is loaded, the lid will be placed on the cask. The cask will be stored temporarily until transferred to T Plant. The loading area includes contingency/surge storage that may include storage for up to 50 drums of solidified sludge. The loading and contingency/surge drum storage area will be on paved surfaces and will include shielding (e.g., concrete culverts, blocks or other shielding). Drums will be protected from water infiltration due to weather during storage. The total capacity of storage outside the CVDF including waste in a loaded cask will therefore be 60 or less drums of stabilized sludge. The transfer of drums of treated sludge to T Plant and interim storage of treated sludge at T Plant are described in Phase 4 of the remedial design.

RadPro® is a registered trademark of Environmental Alternative, Inc, Keene, New Hampshire.

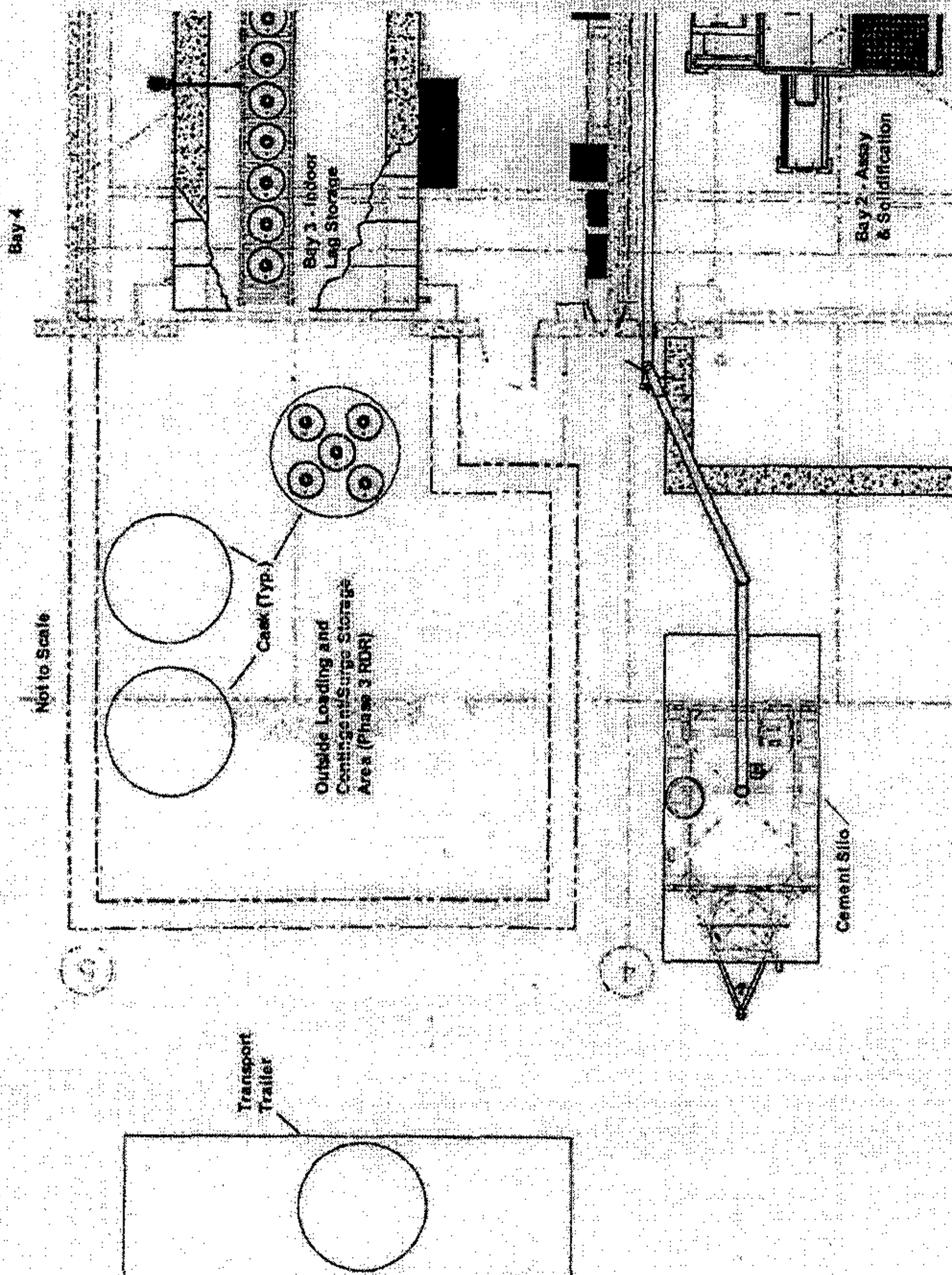


Figure 2-11. CVDF Outside Loading and Contingent/Surge Storage

Interfaces and External Systems

The Assay, MOSS and drum handling systems are operated in conjunction with the several external systems, which are not directly part of the Assay System and MOSS but are integral to their operation. These include:

- Corrosion Vessel
- External Cement Silo and Transfer Equipment
- Centralized Ventilation System
- Shielding

Corrosion Vessel

The Corrosion Vessel (TRT-TK-201) supplies corroded sludge to the Assay Vessel (TRT-TK-301). The Corrosion Vessel is described in Phase 2, *Corrosion of Sludge* of this remedial design.

External Cement Silo and Transfer Equipment

The cement silo system, CEM-TK-050, is located outside the CVDF building (Figure 1-1 and Figure 2-11) and provides bulk storage of cement powder used in the stabilization of sludge. The cement powder is delivered by truck and offloaded pneumatically. Batches of cement powder are conveyed from the bulk silo to the MOSS cement day hopper inside the building by screw feeder as needed. The silo has a capacity of approximately 800 ft^3 and based on current processing estimates, approximately 2,100 ft^3 of cement will be processed through the silo. The silo is equipped with a baghouse that will be operated during the pneumatic loading of the silo from tanker trucks. Baghouse emissions will be monitored during silo loading by operational personnel using EPA Method 22 – *Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares*. EPA Method 22 does not require that the opacity of emissions be determined. Rather the procedure requires only the determination of whether visible emissions occur over a 3 minute period and does not require the determination of opacity levels.

Ventilation System

Operation of the Assay System and MOSS have the potential to emit radioactive airborne contaminants. The systems or subsystems with emission points include the Assay Vessel (TRT-TK-301), the wet dosing head hood, the wet dosing station drip pan ventilation hood, and the dry dosing subsystem vent hood. Emission points from the SSAPS with the exception of the external cement silo are connected to a SSAPS emissions system which is connected to the CVDF centralized ventilation system. The CVDF centralized ventilation system is discharged via the CVDF main stack. Since emissions from the Assay Vessel and MOSS sources contribute only a fraction of the total SSAPS emissions, estimates for anticipated radiological emissions from the SSAPS to the centralized ventilation system, a description of modifications to the existing control equipment to treat off-gas generated from the corrosion system and the assay and solidification systems and emissions monitoring for the centralized ventilation system are described in Phase 2 of the remedial design..

Shielding

Biological shielding to reduce the radiological dose to workers to acceptable levels during normal operations is provided for the Assay and MOSS systems located in Bay 2, lag storage in Bay 3 and outside loading and contingency/surge storage area. In the event of off normal conditions additional shielding will be used, as necessary.

Shielding for the Assay System includes lead and carbon steel shielding of the Assay Vessel (Figures 2-4, 2-6 and 2-7) and metering pump. A concrete shield wall separates operators from the Assay System, MOSS and drums of treated waste in Bay 2 (Figure 2-1). The shield wall is equipped with a shield window at the decontamination station. Drums of treated waste are transferred from Bay 2 to Bay 3 through a shielded door

The Bay 3 lag storage area (Figure 2-2) includes concrete shield walls along the length of the lag storage area (i.e., conveyor) and removable shield panels above the conveyor. The drum loading and contingency storage area outside the CVDF will be shielded using concrete culverts, blocks or other shielding.

DESIGN BASIS – PHASE 3

ARARs and TBC Material

Applicable or Relevant and Appropriate Requirements (ARARs), other criteria, advisories, or guidance to-be-considered (TBC) that apply to the entire K Basin STP, other design considerations and compliance demonstrations for each requirement are summarized in the *RDR/RAWP for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage* (DOE-RL, 2006). Details of the ARARs, TBC material and other design considerations that apply to Phase 3, *Sludge Assay and Solidification* of the K Basin STP are described below.

Waste Management Standards

Land Disposal Restrictions; (40 CFR 268), (WAC 173-303-140)

The Land Disposal Restrictions (LDR) (40 CFR 268) pursuant to the *Resource Conservation and Recovery Act* (42 USC 6901, *et seq.*) are applicable for establishing treatment standards and storage requirements prior to disposal of any dangerous or mixed wastes generated as part of the K Basins interim remedial action. The Washington Administrative Code (WAC) LDRs incorporate the Federal RCRA LDR Requirements in 40 CFR 268 and introduce additional requirements for State-only dangerous wastes. K Basin sludge has been characterized and determined to not be a hazardous waste (DOE-RL, 2001).

40 CFR 761, PCB Waste Management and Disposal:

Regulations regarding polychlorinated biphenyl (PCB) wastes apply to the storage and disposal of K Basins sludge; a multi-phasic PCB waste as described in 40 CFR 761.1(b)(4) and a PCB remediation waste (40 CFR 761.3). As described in the *RDR/RAWP for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage* (DOE-RL, 2006), while the measures to protect human health and the environment from the PCBs and remote-handled radioactive waste are similar, hazards associated with the radiological characteristics of the sludge are more significant. Management of the sludge for its radiological hazards is in excess of that necessary to manage the low PCB hazards associated with this waste and therefore the waste will be managed based only on its radiological hazards. Additional information concerning the engineering controls associated with managing the sludge is discussed in Section 2.0 of this RDR, the RDR/RAWP (DOE-RL, 2006) and the additional design phases of this remedial design.

10 CFR 61 , Licensing Requirements for Land Disposal of Radioactive Waste

Relevant and appropriate requirements in 10 CFR 61 are the general prohibition on near-surface disposal of greater-than-class-C (GTCC) radioactive waste and the general performance objectives stated in 10 CFR 61.40. Waste classification (10 CFR 61.55) and waste characterization (10 CFR 61.56) are relevant and appropriate to the disposal of radioactive wastes. The SSAPS radioactive waste primarily includes RH TRU. Some sludge heels and flush waters generated during operation and deactivation of the IPAN and MOSS will be solidified in the MOSS using cement. These treated wastes may be GTCC waste or low-level waste (LLW).

RH TRU, contact-handled (CH) TRU and LLW characterization requirements are addressed through meeting requirements in the TBC material. RH TRU waste characterization requirements are identified in the *Hanford Site Solid Waste Acceptance Criteria* (FH, 2006a) which incorporates meeting the RH requirements from the *RH TRU Waste Characterization Program Implementation Plan for the Waste Isolation Pilot Plan* (WCPIP) (DOE/WIPP, 2003) and CH-TRU waste characterization requirements from the *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant* (DOE/WIPP, 2002a). LLW characterization requirements are identified in the Environmental Restoration Disposal Facility (ERDF) Waste Acceptance Criteria (WAC) (BHI, 2002) and the Hanford Site Solid WAC. Characterization of wastes will be addressed through development of one or more sampling and analysis plans (SAPs). The SAP(s) will include evaluation for GTCC where appropriate.

Waste acceptance criteria for ERDF prohibit the disposal of GTCC waste at the ERDF. The waste acceptance criteria for the Hanford low-level burial ground permits disposal of low-level GTCC waste in lined trenches. RH TRU wastes treated through the SSAPS will be transferred to T Plant for interim storage pending disposal at the WIPP. Any CH-TRU that may result from the treatment will be transferred to the 200 Area for interim storage and disposal at the WIPP.

40 CFR 191, Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste

The requirements in 40 CFR 191 are applicable to TRU waste generated by the K Basins interim remedial action. On-site disposal of TRU waste is prohibited by this regulation. No on-site disposal of TRU waste will occur. Waste acceptance criteria for Hanford Site disposal facilities (i.e., low-level burial grounds and ERDF) prohibit TRU waste. TRU wastes treated during this project will be stored for eventual disposal at the WIPP, a geologic repository. The waste characterization methods included in the WCPIP will allow sites that generate RH TRU waste to satisfy EPA's regulatory requirements in 40 CFR Part 191 (Subparts B and C) and Part 194 (EPA, 1993; EPA, 1996), the EPA final certification decision, and the WIPP Land Withdrawal Act.

Characterization of wastes from the STP will be addressed through development of one or more SAPs submitted to the EPA for approval. Any CH-TRU waste generated during this remedial action will be managed according to the existing certified Hanford CH-TRU program.

To-Be-Considered Material pursuant to relevant facility acceptance criteria

Environmental Restoration Disposal Facility Waste Acceptance Criteria (BHI-00139)

The ERDF WAC establishes waste acceptance criteria for ERDF. Waste destined for management at ERDF must meet acceptance criteria to ensure proper disposal. Some sludge heels and flush waters generated during operation and deactivation of the IPAN and MOSS will be solidified in the MOSS using cement. These treated wastes may be GTCC or LLW. SAPs for waste streams that may be disposed of at the ERDF will address ERDF waste acceptance criteria and be approved by EPA.

Remote-Handled Transuranic Waste Characterization Program Implementation Plan for the Waste Isolation Pilot Plan (DOE/WIPP-02-3214)

The RH TRU WCPIP (DOE/WIPP, 2003), as approved by the EPA (EPA, 2004) establishes one of the bases for the development of generator site RH TRU waste characterization programs and identifies waste acceptance criteria for RH TRU waste to be managed at the WIPP. RH TRU sludge will be treated during this remedial action. The design of the treatment system and operational processes address requirements in the WCPIP to prepare a waste form that may be certified in the future for disposal at the WIPP.

A certified RH TRU program will not be in place at the time of sludge treatment. Therefore compliance with requirements in the WCPIP will be met in two parts: 1) through actions undertaken during the remedial action to treat sludge before certification of an RH TRU program based on the requirements identified in the WCPIP and 2) through development of an RH TRU program and future characterization under a certified RH TRU program. Summaries of requirements that will be met during the sludge treatment project and those that will be met after a RH TRU program is developed and certified are included below:

Requirements implemented during treatment at CVDF:

The IPAN system will assay corroded sludge prior to solidification to ensure appropriate identification and quantification of radionuclides. Assayed sludge will be metered into the MOSS based on assay results to ensure the solidified sludge meets radioactive waste acceptance criteria identified. The design of the IPAN includes equipment and functions to collect data to determine:

- TRU waste determination (i.e., TRU curie-per-gram [Ci/g] concentration of waste in each waste stream to demonstrate the waste contains greater than 100 nanocuries per gram [nCi/g] of alpha-emitting TRU radionuclides with half-lives greater than 20 years),
- Radionuclide activity (including ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs),
- Total activity (necessary to comply with the WIPP Land Withdrawal Act limit of 5.1 million curies of RH TRU waste),
- Activity limit per canister (23 curies per liter including two times the TMU expressed in terms of one standard deviation, averaged over the volume of the waste drum),
- RH determination (a surface dose rate of 200 millirem per hour or greater), and
- Surface dose rate to ensure that less than five percent of the payload containers have dose rates greater than 100 rem/hr unshielded and that none have dose rates greater than 200 rem/hr[2].

2 WCPIP waste acceptance criteria specify that surface dose rates of payload containers must be equal to or greater than 200 mrem/hr and less than 1000 rem/hr. The WIPP will track the dose rates and volumes of containers to ensure that no more than five percent by volume of the RH TRU waste received at the WIPP has a surface dose rate in excess of 100 rem/hr (DOE/WIPP, 2003, Section 2.4.4). Project specific surface dose rates were established to ensure that less than five percent of the payload containers have dose rates greater than 100 rem/hr unshielded and that none have dose rates greater than 200 rem/hr based on the Hanford Site Waste Acceptance Criteria (FH, 2006a).

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The IPAN data output also supports AK package development.

The IPAN system will interface with software designed to manage IPAN data and determine radionuclide loading limits for each waste container. The determination of radionuclide loading will be based on the IPAN data combined with the Assay Vessel volumetric data, sludge feed mass and density data, and waste stream isotopic data determined from AK. The software will also quantify the ^{137}Cs activity and TMU based on gross gamma measurement. Output from the software will document aspects of AK information for each drum. The software will be designed to meet requirements that are in effect equivalent to NQA-1 software QA requirements identified in the WCPIP.

MOSS treatment is designed to solidify the corroded assayed sludge in 55-gallon packages. The MOSS design includes:

- Solidification to meet requirements for residual liquids (<1%) in the waste, gross 55-gallon container weight (≤453.59 kg), and prepare a waste form to meet physical form requirements (i.e., WIPP Summary Category Group S3000, homogenous solids). Compliance with the residual liquid requirement will be met through knowledge of batch processing periods for similar materials and Visual Examination (VE) of process instrumentation.
- The MOSS design includes CCTV to monitor process steps. VE of the process using CCTV supports meeting requirements to confirm AK.

Additional information concerning the design of the IPAN system and MOSS are provided in Section 2, *Remedial Design.*

A SAP will be developed for the treatment of RH TRU sludge using the EPA Data Quality Objective (DQO) process described in the WCPIP (DOE, 2003) and *EPA Guidance for Data Quality Objective Process*, EPA QA/G-4 (EPA, 2000) to document details of compliance with substantive requirements of the WCPIP not included in the equipment design. The SAP will serve to ensure appropriate data and AK information are collected and used to meet requirements that apply to the STP phase of work and document that the process results in a waste form that may be certified in the future for disposal at the WIPP. The SAP will discuss:

- Nondestructive assay (NDA) proposed (IPAN including gross gamma measurements), IPAN TMU, and use of assay data and gross gamma data to develop; TRU waste determination, Radionuclide activity, Total activity, Activity limit per canister, and RH determination,
- Residual liquids, including Visual Examination (VE), how the waste stream and individual containers VE DQOs and QAOs are met and associated training,
- AK information development for characterization information collected during the STP,
- Quality assurance / quality control (QA/QC) requirements for activities within the scope of the SAP to meet the requirements of the WCPIP.

The SAP will be submitted to the EPA for review and approval.

The sludge treatment design and operation will be conducted under a QA program that is equivalent in effect to ASME NQA-1-1989 edition, *Quality Assurance Requirements for Nuclear Facility Applications,* ASME NQA-2a-1990 addenda, part 2.7, of ASME NQA-2-1989 edition, and ASME NQA-3-1989 edition (excluding Section 2.1 (b) and (c) and Section 17.1). The WIPP WCPIP and 40 CFR 194.22 allow qualification of information collected prior to the establishment of an RH TRU QA Program designed to meet the requirements of the CBFO Quality Assurance Program Document provided the information is collected under a QA program that is in effect equivalent to the listed standards[3].

Reporting will be conducted as described in the *RDR/RAWP for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage* (DOE-RL, 2006), Section 4.6, Project Closure Documentation.

Requirements deferred for implementation under a certified RH TRU Program in the future

Development and certification of an RH TRU Program at Hanford will be conducted in the future. RH TRU treated during the STP and stored at T Plant will require additional AK information development, qualification of existing AK information, confirmatory testing and certification in the future under a certified RH TRU Program. As such, requirements listed in the WCPIP that relate to the development of an RH TRU Program and associated documents and implementation of them are deferred until the future. In addition, implementation of some requirements are either not necessary at this time or do not need to be performed to the same rigor identified in the WCPIP at this time. Therefore these activities are deferred until implementation under the certified RH TRU Program in the future. While a comprehensive list of these is difficult to summarize herein, activities deferred until the future include:

- Collection of drum surface dose rates using a method equivalent to that identified in the WCPIP. (Surveys will be performed under current radiological control program requirements to meet T Plant acceptance criteria.)
- Qualification of existing radionuclide AK information, including TMU development, to meet the standards identified in the WCPIP.
- Qualification of existing AK information.
- Development of AK information for cellulose, plastic, rubber; metals; Defense Activity Determination; and establish physical form (i.e., S3000, homogenous solids).
- Confirmatory testing.
- Reconciliation of DQOs, quality assurance objectives (QAOs) and development of an AK Summary Report for other than 1) that identified in the RH TRU SAP identified previously, 2) documentation of the sludge treatment, characterization and process to form AK information that will be qualified in the future, and 3) project closure documentation referenced previously.

[3] DOE/WIPP-02-3214, *Remote-Handled Transuranic Waste Characterization Program Implementation Plan for the Waste Isolation Pilot Plan*, Section 4.3, Qualification of AK Information.

Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-02-3122)

The *CH-TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant* (DOE/WIPP, 2002a) establishes waste acceptance criteria for CH-TRU waste destined for management at the WIPP. CH-TRU waste streams, such as dilute sludge heels may be generated during the operation or deactivation of the treatment system that will require solidification. Drums of treated sludge that have surface dose rates <200 millirem per hour (i.e., do not meet the surface dose rates to be considered an RH waste) but meet the other TRU criteria are considered CH-TRU. The Hanford site has a certified CH-TRU program in place. CH-TRU stabilized sludge generated through the STP will be transferred to the 200 Area for management under the certified CH-TRU program. AK information developed during the sludge treatment will be used to support the CH-TRU characterization.

Standards Controlling Emissions to the Environment

National Emission Standards for Hazardous Air Pollutants (40 CFR 61); *Radiation Protection - Air Emissions,* (WAC 246-247); *Ambient air quality standards and emission limits for radionuclides,* (WAC 173-480-070-(2))

Substantive requirements of these standards apply because this remedial action includes onsite treatment of radioactive sludge, operation of emissions systems and generation of radioactive contaminated waste and debris during operation and system deactivation. Substantive requirements include:

- 40 CFR 61.92 - Emissions of radionuclides to the ambient air shall not exceed amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.
- 40 CFR 61.93 - Emissions from major point sources of airborne radioactive material shall be measured. Measurement techniques may include, but are not limited to, sampling, calculation, smears, or other reasonable methods for identifying emissions.
- WAC 246-247-040(3) and WAC 173-480-060- Emissions from new construction or significant modifications to existing systems shall be controlled to assure emission standards are not exceeded and/or to ensure that emissions are controlled using Best Available Radionuclide Control Technology (BARCT).
- WAC 246-247-075(8) - Emissions from minor point sources and non-point and fugitive sources of airborne radioactive material shall be measured.
- WAC 173-480-050-(1) - At a minimum all emission units shall make every reasonable effort to maintain radioactive materials in effluents to unrestricted areas, as low as reasonably achievable (ALARA). Control equipment of facilities operating under ALARA shall be defined as reasonably available control technology (RACT).
- WAC 173-480-070-(2) - Determine compliance with the public dose standard by calculating exposure at the point of maximum annual air concentration in an unrestricted area where any member of the public may be.

The SSAPS which will be installed in the CVDF will result in radiological air emissions. The corrosion system, which includes evaporation, Assay Vessel and MOSS drum dosing head and drip pan ventilation systems, will connect to the CVDF centralized ventilation system. Control equipment will be installed to treat air emissions from the SSAPS prior to being discharged to the centralized ventilation system and the CVDF main stack. Since emissions from the IPAN and MOSS contribute only a fraction of the total SSAPS emissions, estimates for anticipated radiological emissions from the SSAPS to the centralized ventilation system, a description of modifications to the existing control equipment to treat off-gas generated from the corrosion system and the assay and solidification systems and emission monitoring for the centralized ventilation system are described in Phase 2 of the remedial design.

In addition to point source radioactive air emissions, fugitive emissions will be generated within the CVDF from operations. Fugitive radiological air emissions are monitored using the established Near Facility Monitoring Program, which includes monitors within the 100-K Area.

Drums of treated waste will be decontaminated to meet Hanford WAC for RH waste (FH, 2006b) on exiting the MOSS prior to transfer to the lag storage area in Bay 3 of the CVDF. The WAC includes requirements for limiting removable surface contamination to be < 20 dpm/100 cm2 for alpha and < 200 dpm/100cm2 for beta-gamma. Upon arrival at the drum swabbing and decontamination station, an overall swipe is made of all drum surfaces in order to detect the presence of surface contamination. If surface contamination is detected, the drum will be decontaminated and rechecked for the presence of surface contamination until the requirement is met. Records of the surface contamination survey results will be maintained in the Data Management System.

General Regulations for Air Pollution, (WAC 173-400)

Substantive requirements of this standard are applicable to this remedial action because there may be visible, particulate, fugitive, and hazardous air emissions resulting from material handling, corrosion or stabilization activities[4]. As a result, standards established for the control and prevention of air pollution are applicable.

- WAC 173-400-040 - Methods of control shall be employed to minimize the release of air contaminants associated with fugitive emissions resulting from materials handling, construction, demolition, or other operations. Emissions are to be minimized through application of best available control technology.

Visible emissions subject to requirements in WAC 173-400-040 have the potential to be emitted from the external cement silo (CEM-TK-050) baghouse during transfer operations from cement transport vehicle tanks to the silo and during pneumatic transfers. The cement storage and transfer system design includes a baghouse to control the emission of particulates that could result in visible emissions. Visible emissions from the external cement silo will be evaluated during startup of cement transfer equipment and periodically during cement transfers by operations personnel using EPA Method 22 – *Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares*. The dry dosing head of the MOSS is also ventilated through a bag-filter to collect dust prior to being routed to the

[4] Emissions with odors subject to regulation under WAC 173-400-040 are not anticipated during this aspect of the remedial action.

centralized ventilation system to protect the treatment system which includes HEPA filtration. Visible emissions monitoring of the CVDF main stack is not proposed.

Fugitive dust may be generated during the handling of cement from the external cement silo which located outside the CVDF. Fugitive dust will be controlled as necessary using water spray and mist.

Hazardous air emissions for new sources of air emissions, (WAC 173-400-113 and WAC 173-460)

Emissions points from the IPAN and MOSS systems (i.e., the Assay Vessel, wet dosing head hood, wet dosing station drip pan hood and dry dosing head hood) are connected to a treatment skid which connects to the centralized ventilation system and will be discharged via the CVDF main stack. Since emissions from these sources contribute only a fraction of the total SSAPS emissions, toxic air contaminants will be evaluated during the development of Phase 2, *Corrosion of Sludge* of the remedial design and controls will be submitted in conjunction with Phase 2 of the remedial design.

Standards for Protecting Human Health

The *Nuclear Regulatory Standards for Protection Against Radiation* (10 CFR 20); *Radiation Protection Standards* (WAC 246-221); *Environmental Radiation Protection Standards for Nuclear Power Operations* (40 CFR 190); and *Department of Energy Occupational Radiation Protection* (10 CFR 835)

Regulations under 10 CFR 20, WAC 246-221 and 40 CFR 190 are relevant and appropriate to establishing public dose limits for activities implemented under the K Basins interim remedial action. Regulation under 10 CFR 835 is applicable to activities undertaken as part of the K Basins interim remedial action. Substantive requirements and compliance processes are described in the *RDR/RAWP for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage* (DOE-RL, 2006).

Other Design Considerations

Waste characterization requirements for RH TRU sludge that were evaluated for this project included those identified in the WCPIP (i.e., TBC material previously described), Hanford site waste acceptance criteria for RH TRU, Appendix I[5] and the *Remote-Handled Transuranic Waste Authorized Methods for Payload Control* (RH TRAMPAC) (DOE/WIPP, 2002b). While not included as an ARAR or TBC, the remedial design of the IPAN and MOSS considered the substantive applicable requirements for characterization from the RH TRAMPAC to ensure treated waste would meet the loading limits specified in the RH TRAMPAC to support efficient shipping of RH TRU to the WIPP as described below.

RH TRAMPAC Characterization

Remote-Handled Transuranic Waste Authorized Methods for Payload Control (RH TRAMPAC), RH TRU 72-B Cask Safety Analysis Report, Appendix 1.3.7.

[5] HNF-EP-0063 consolidates and summarizes requirements identified in the WCPIP and RH TRAMPAC. Therefore requirements for HNF-EP-0063 are not reiterated here.

Requirements in the RH TRAMPAC are established to ensure compliance of the payload with the transportation parameters of the 72-B Cask. The RH TRAMPAC defines substantive payload requirements that apply to the stabilization and packaging of sludge under the following categories[6]:

1. Container and physical properties
2. Nuclear properties
3. Chemical properties
4. Gas generation
5. Quality assurance

Container and physical properties

- Container description: The only authorized payload container for the 72-B Cask is the RH TRU waste canister. Packaging the sludge-filled drums into the RH TRU waste canister for shipment in the 72-B Cask will be performed in the future. The RH TRU canister accommodates three 208 L (55-gallon) drums. Sludge waste will be packaged in DOT-7A 55-gallon drums.
- Container/cask weight: The payload of each RH TRU canister and 72-B cask package will be determined in the future prior to shipping RH TRU waste. To ensure that the canister/cask weight requirements of the RH TRAMPAC are met; calculations to determine the expected drum weights and provisions for weighing of the drum during and following packaging of the sludge has been provided in the design. The maximum weight for a filled drum is estimated to be less than the maximum required to meet the RH TRAMPAC requirements.
- Container marking: Each drum will have a unique barcode placed on the drum before entering the facility. The bar code is read remotely by a bar code reader and input to the Programmable Logic Controller prior to entry into the MOSS system. Cameras placed in Bay 2 allow VE operators to confirm drum identification throughout the process. Drums to be transported as a payload in the 72-B Cask will be determined in the future prior to shipping.
- Filter Vents: NucFil® filters included in the design of the sludge waste containers meet the specifications for filters. The method of compliance will be administrative and procurement controls demonstrating that filter vents have been procured to the specifications of Appendix 1.3.5 of the RH TRU 72-B Cask Safety Analysis Report and the Hanford Site Solid WAC, Appendix I. In addition visual inspection of drums will be performed prior to filling.
- Liquid Waste: Liquid waste is prohibited in the payload container except for residual amounts in well-drained containers. The total volume of residual liquid in the payload container shall be less than 1 volume percent of the payload container. Compliance with this requirement will be met through knowledge of batch processing periods for similar materials.

[6] Payload assembly requirements were not included since these activities are in the future and will occur under a certified RH TRU program in the future.

- Sharp/heavy objects and sealed containers: There are no planned sharp objects or sealed containers to be placed in the drums. The only potentially heavy item in the drum is the paddle (i.e., lost stirrer) used for mixing the grout. This stirring mechanism is held in place by a pin at the bottom of the drum and the upper mixer paddle guide attached to the drum lid. The stirring mechanism is not removed after mixing, but remains in the drum, grouted within the waste matrix. Visual examination of the drum from the time that it arrives at the packaging facility until the waste is fully grouted will ensure sealed containers are not added to the drum before or during waste packaging.

Nuclear properties

- Nuclear criticality (Unrestricted Case): Under this case, the RH TRU waste canister is acceptable for transport only if plutonium (^{239}Pu) FGE, plus error (one standard deviation), is 325 grams or less. The IPAN system has been designed to determine the FGE of the Assay Vessel for use in developing sludge/water/cement proportions in a drum processed through the MOSS to efficiently meet the FGE requirement based on drum configurations in an RH TRU waste canister.
- Isotopic Composition: The isotopic composition of the RH TRU waste is determined from documented process knowledge and existing analytical data.
- Quantity of Radionuclides: The IPAN is designed to determine ^{239}PU FGE and gross gamma. Remaining radionuclides are scaled from these based on known isotopic ratios. The quantity of radionuclides will therefore be developed based on measured and calculated information. Passive Active Neutron (PAN) Assay and calculations are accepted compliance methodology.
- Radiation dose rate: The external radiation dose rates of the 72-B Cask are required to be $\leq$ 200 mrem/ per hour at the surface and $\leq$ 10 mrem/hour at 2 meters from the side of the package under normal conditions of transport. Under accident conditions, the external radiation dose rate of the 72-B Cask are required to be $\leq$ 1 rem per hour any point 1 meter from the surface of the cask. RH TRU will not be shipped at this time; however the sludge/makeup water/cement ratios will be formulated to ensure the grouted waste form will meet the dose rate requirement. During operations, the predicted dose rate is calculated using a combination of process measurements, IPAN system measurements, AK, and algorithms in the control system to determine the quantity of sludge that can be put into an individual drum. A gamma monitor, located in Bay 2 downstream of the MOSS, is used to measure the contact dose rate.

Chemical Properties

- Pyrophoric materials: Both radioactive and nonradioactive pyrophoric materials are limited to residual amounts (less than 1 weight percent) in the RH TRU waste canister. Corroded sludge received at the IPAN Assay Vessel will not be pyrophoric. There were no design considerations required in IPAN or MOSS to address this requirement.
- Explosives, corrosives, and compressed gases (pressurized containers) are prohibited in the payload. Corroded sludge received at the IPAN Assay Vessel will not be explosive or corrosive. Similarly there are no means for compressed gases to enter a drum. There were no design considerations required in IPAN or MOSS to address this requirement.

- Chemical composition: Allowable materials and chemicals for each site-specific waste content code are described in the RH Transuranic Content Codes (TRUCON) (DOE/WIPP, 2001). The RH TRUCON for the K Basins sludge waste stream has not yet been developed. Chemical composition of the waste, including radionuclide content, has been determined based on sampling and analysis of the sludge in the K Basins[7]. During operations, IPAN system measurements and algorithms in the control system are used to determine the quantity of sludge that can be put into an individual drum to meet FGE, curie, dose, hydrogen and residual liquid limits. The RH TRUCON for the sludge waste stream will be developed in preparation to ship the material based on the referenced information and AK developed during the STP.
- Chemical compatibility: The RH TRUCON for the K Basins sludge has not yet been developed; however, sludge characterization data show that the sludge is not corrosive based on pH test data from samples of sludge from the floor and pits of the KE Basin, as well as canister sludge from both basins. While no test data are available for KW floor and pit sludge, the KE sludge is considered to be representative of KW sludge (DOE-RL, 2001). Further, Portland cement that is added as the treatment agent, once cured is not corrosive. No constituents incompatible with the 72-B cask or the RH TRU canister have been identified.

Gas generation

- Hydrogen generation: The hydrogen generated must be limited to a molar quantity that would be no more than 5 percent by volume of the innermost layer of confinement (or equivalent limits for other inflammable gases, if present) at standard temperature and pressure. The gases generated in the payload and released into the 72-B cask cavity shall be controlled to maintain the pressure within the cavity below the acceptable design pressure of 150 pounds per square inch. Waste formulation and addition to drums will be controlled to meet hydrogen gas generation rates
- Flammable VOCs: Sampling and analysis of sludge (WHC, 1996) indicates Volatile Organic Compound (VOC) concentrations in the sludge fall below the limits established in the RH TRAMPAC. Any VOCs in the sludge as well as any added as a result of processing are expected to be eliminated during the corrosion process. Details of the corrosion process are described in Phase 2, *Corrosion of Sludge*.

Quality Assurance

The RH TRAMPAC requires that certification of authorized contents for shipment in the RH TRU 72-B cask shall be performed under a written QA program that provides confidence, for both the shipper and receiver, that the RH TRAMPAC requirements have been met. Although certification of the payload will not be performed at this time, RH TRAMPAC payload characterization activities described in this RDR will be performed under a QA/QC program that is in effect equivalent to the requirements of the WCPIP, Section 4.3.4. A SAP

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[7] *105-K Basin Material Design Basis Feed Description for Spent Nuclear Fuel Project*, HNF-SD-SNF-TI-009, Volume 2 (FH, 2001); *Spent Nuclear Fuel Technical Databook, Volume 2, Sludge*, HNF-SD-SNF-TI-015 (FH, 2006b); and *Supporting Basis for Spent Nuclear Fuel Project Sludge Technical Databook*, SNF-7765 (FH, 2006c).

for WCPIP and RH TRAMPAC characterization activities (see Section 2.1.1, WCPIP) will be submitted to the EPA for review and approval.

Hanford Site Solid Waste Acceptance Criteria

The *Hanford Site Solid Waste Acceptance Criteria* (FH, 2006a) identifies the requirements for the acceptance of waste at Hanford Site Solid waste management facilities. Requirements include general and facility specific requirements that must be met. Aspects of the requirements from the RH TRAMPAC and conformance with the WCPIP are incorporated into the WAC and individual sections of this RDR for RH TRU and therefore are not reiterated.

REFERENCES – PHASE 3

BHI, 2002, BHI-00139, Rev 4, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 2001, DE-RL, P.G. Loscoe, DOE-RL to D.R. Sherwood, EPA and M.A. Wilson, Department of Ecology, *Completion of Designation for K Basins Sludge Waste Streams*, March 2001.

DOE-RL, 2005, DOE/RL-99-89, *Remedial Design Report and Remedial Action Work Plan for the K Basins Interim Remedial Action: Supplement 2: K East Basin North Loadout Pit Sludge Treatment*, Rev. 1, June, 2005, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2006, DOE/RL-2006-06, *Remedial Design Report / Remedial Action Work Plan (RDR/RAWP) for the K Basins Interim Remedial Action: Sludge Treatment and Interim Storage*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/WIPP, 2001, DOE/WIPP-90-045, *Remote-Handled Transuranic Content Codes*, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

DOE/WIPP, 2002a, DOE/WIPP-02-3122, *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

DOE/WIPP, 2002b, *Remote-Handled Transuranic Waste Authorized Methods for Payload Control (RH TRAMPAC)*, Rev. 3, Appendix 1.3.7, *RH TRU 72-B Cask Safety Analysis Report*, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

DOE/WIPP, 2003, DOE/WIPP-02-3214, *Remote-Handled Transuranic Waste Characterization Program Implementation Plan for the Waste Isolation Pilot Plan*, Rev. 0D, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico.

EPA, 1999, EPA/ROD/R10-99/059, *Record of Decision for the K Basins Interim Remedial Action*, U.S. Environmental Protection Agency, Richland, Washington.

EPA, 2000, *Guidance for Data Quality Objective Process*, EPA QA/G-4, EPA/600/R-96/055, U.S. Environmental Protection Agency, Washington, DC.

EPA, 2003, U.S. Environmental Protection Agency, Letter and enclosed *Conditions of Approval* from Carl E. Edlund (Director, Multimedia Planning and Permitting Division, U.S. EPA) to Ines R. Triay (Manager, Carlsbad Field Office, DOE), dated May15, 2003.

EPA, 2004, U.S. Environmental Protection Agency, Letter and Enclosure from Frank Marcinkowski, (Director, Radiation Protection Division) to R. Paul Detwiler, (Acting Manager, Carlsbad Field Office, U.S. DOE) dated March 26, 2004

EPA, 2005, *ROD Amendment for the K Basins Interim Remedial Action,* U.S. Environmental Protection Agency, Richland, Washington.

FH, 2001, *105-K Basin Material Design Basis Feed Description for Spent Nuclear Fuel Project, Volume 2, Sludge,* HNF-SD-SNF-TI-009, Rev. 4, Fluor Hanford, Richland, Washington.

FH, 2006a, *Hanford Site Solid Waste Acceptance Criteria,* HNF-EP-0063, Fluor Hanford, Richland, Washington.

FH, 2006b, *Spent Nuclear Fuel Technical Databook, Volume 2, Sludge,* HNF-SD-SNF-TI-015, Rev. 13, Fluor Hanford, Richland, Washington.

FH, 2006c, *Supporting Basis for Spent Nuclear Fuel Project Sludge Technical Databook,* SNF-7765, Rev 3B, Fluor Hanford, Richland, Washington.

WHC, 1996, HNF-SP-1182, *Analysis of Sludge from K East Basin Floor and Weasel Pit,* 1996, Westinghouse Hanford Company, Richland, Washington.